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NATIONAL DAM SAFETY PROGRAM. ASPENHOFF LAKE DAM (MO 11006), MIS--ETC(U)
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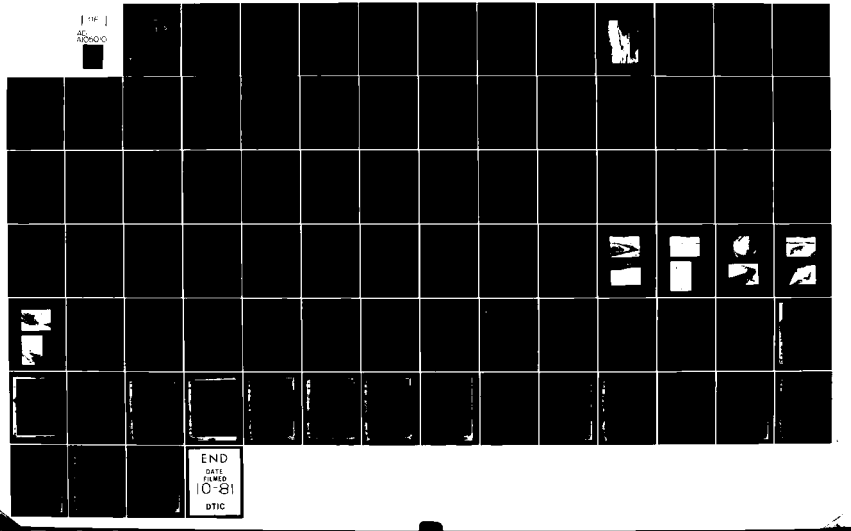

MISSISSIPPI·KASKASKIA·ST. LOUIS BASIN

LEVEL I

ASPENHOFF LAKE DAM
WARREN COUNTY, MISSOURI
MO 11006

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM.

Aspenhoff Lake Dam (MO 11006),
Mississippi - Kaskaskia - St. Louis Basin,
Warren County, Missouri. Phase I Inspection
Report.

United States Army
Corps of Engineers
Serving the Army
Serving the Nation

St. Louis District

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(11) Sep 79

(9) Final rept.,

(10) Walter G. /Shifrin

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

SEPTEMBER, 1979

UNCLASSIFIED

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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
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4. TITLE *(and Subtitle)* Phase I Dam Inspection Report National Dam Safety Program Aspenhoff Lake Dam (MO 11006) Warren County, Missouri	5. TYPE OF REPORT & PERIOD COVERED Final Report 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Consoer, Townsend and Associates, Ltd.	8. CONTRACT OR GRANT NUMBER(s) DACW43-79-C-0075
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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18. SUPPLEMENTARY NOTES

19. KEY WORDS *(Continue on reverse side if necessary and identify by block number)*

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Aspenhoff Lake Dam (Mo. 11006) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Aspenhoff Lake Dam (Mo. 11006).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood
2) Overtopping could result in dam failure
3) Dam failure significantly increases the hazard to loss of life downstream

SUBMITTED BY: SIGNED
Chief, Engineering Division

14 SEP 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

14 SEP 1979
Date

ASPENHOFF LAKE DAM
WARREN COUNTY, MISSOURI

MISSOURI INVENTORY NO. 11006

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
CONSOER, TOWNSEND AND ASSOCIATES LTD.
ST. LOUIS, MISSOURI
AND
ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO
A JOINT VENTURE

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

SEPTEMBER 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam: Aspenhoff Lake Dam, Missouri Inv. No. 11006
State Located: Missouri
County Located: Warren
Stream: Unnamed Tributary of Hopewell Creek
Date of Inspection: May 15, 1979

Assessment of General Condition

Aspenhoff Lake Dam was inspected by the engineering firms of Consoer, Townsend and Associates LTD., of St. Louis, Missouri, and Engineering Consultants, Inc. (A Joint Venture) using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. The estimated damage zone extends about one mile downstream of the dam. Within the damage zone are three houses, one small gravel road, and one county road crossing which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Aspenhoff Lake Dam is in the

small size classification since it is less than 40 feet high and impounds less than 1,000 acre-feet of water.

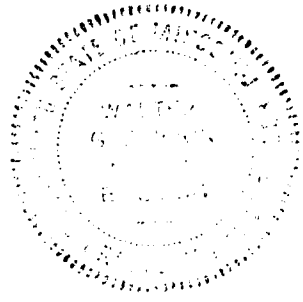
Our inspection and evaluation indicates that the spillway of Aspenhoff Lake Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Aspenhoff Lake Dam being a small size dam with a high hazard potential, is required by the guidelines to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping. Since there is high hazard potential downstream of the dam, the appropriate spillway design flood for this dam is one-half of the Probable Maximum Flood. Based on available data it was determined that the reservoir/spillway system can accommodate 22 percent of the Probable Maximum Flood without overtopping the dam. Our evaluation indicates that the reservoir/spillway system will accommodate the 100-year flood; that is, a flood having a 1 percent chance of being equalled or exceeded during any given year.

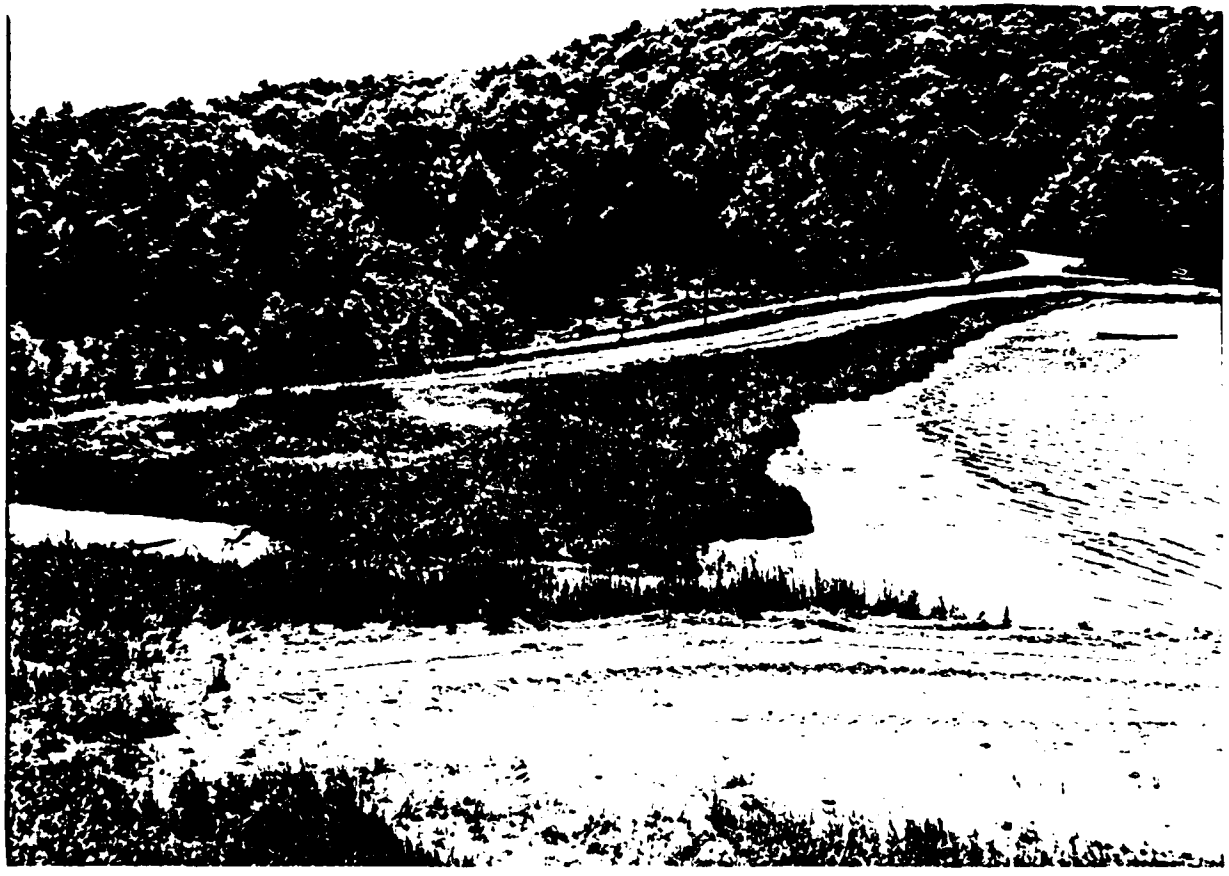
The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

Other deficiencies noted by the inspection team were the erosion and unstable banks of the spillway discharge channel; rodent activity on the upstream slope of the embankment; an open joint between the concrete spillway slab and the vertical drop; voids behind the concrete wall on each side of the spillway channel; a lack of periodic inspection by a qualified engineer; and a lack of maintenance schedule. The lack of stability and seepage analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiency described above.

Walter G. Shifrin, P.E.





Overview of Aspenhoff Lake Dam

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

ASPENHOFF LAKE DAM, I.D. No. 11006

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

ASPENHOFF LAKE DAM, Missouri Inv. No. 11006

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Aspenhoff Lake Dam was carried out under Contract DACW 43-79-C-0075 to the Department of the Army, St. Louis District, Corps of Engineers, by the engineering firms of Consoer, Townsend & Associates Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of Aspenhoff Lake Dam was made on May 15, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an assessment of hydrologic and hydraulic conditions at the site; presents an assessment as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing, and detailed analyses were not within the scope of this study. The conclusions drawn herein, therefore, are based on the presence of, or absence of, obvious signs of distress. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to east abutment or side, and right to the west abutment or side.

d. Evaluation Criteria

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D. These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 Description of the Project

a. Description of Dam and Appurtenances

It should be noted that design drawings are not available for the dam or appurtenant structures. The following description is based exclusively on observations and measurements made during the visual inspection.

The dam embankment is a compacted earthfill structure. The development manager, Mr. Russell Armstrong, said the borrow materials came from the surrounding area. The typical crest width is 15 feet. The crest elevation is approximately 620.5 feet above MSL, and the maximum height of the embankment was measured to be 29.0 feet.

The downstream slope of the embankment was measured as 1V to 3H. It was not possible to measure the upstream slope because of high reservoir level. No riprap was placed on the upstream slope. The entire exposed embankment was covered with grass.

Aspenhoff Lake Dam is situated on the border between the Dissected Till Plain Section of Central Lowlands Physiographic Province which extends to the north and the Ozark Plateau Province to the south. Although the area in which the dam and reservoir are located was glaciated during Pleistocene time, the till and loess which characterize the uplands of the Till Plains have been largely removed by erosion since the end of the Pleistocene. The area is characterized by wooded hills which have gentle to steep slopes.

The bedrock geology of the area as shown by the Geologic Map of Missouri (1979) typically consists of gently northeastwardly dipping sediments of Paleozoic age. To the north of Warren County these beds are often capped by young (Pleistocene) deposits of glacial drift and wind blown loess. In southern areas of the county the bedrocks is generally covered by residual soil, colluvium, or alluvium. The rocks underlying the area are predominately carbonates (limestones and dolomites) although beds of sandstone and shale are not infrequent.

Structurally, as stated earlier, the rocks are dipping gently northeastward off the Ozark uplift to the south of the area of interest.

The bedrock of Warren County contains some minor folding. The largest known geologic structure in the area is a gentle anticline centered about 2 1/2 miles northwesterly of the town of Warrenton. This fold does not apparently affect the beds at the damsite.

The spillway for Aspenhoff Lake Dam is an overflow section with a small concrete channel located near the center of the section. The spillway is located just beyond the left abutment of the dam embankment. The concrete channel in the spillway section is a 6-inch thick concrete pad with a width of 10 feet and a maximum depth of 9 inches. The channel section is grass-lined outside of the concrete pad, and has a total width of 46 feet and a depth of 3.5 feet.

Downstream of the spillway section is a 6 foot vertical drop into the discharge channel. The base of the channel at the location of the drop is covered with rock riprap. The discharge channel is an earth channel having a

depth of approximately 6 feet, a bottom width of 5 feet, and nearly vertical side slopes. Some amounts of riprap have been placed at several locations in the channel section.

A low level drain outlet pipe has been constructed at the dam to make releases from the reservoir as required. The pipe is a 2 1/2 inch diameter polyvinyl chloride pipe with a 2 1/2 inch diameter cast iron gate valve at the downstream end of the pipe. The valve is located in a pit on the downstream slope approximately 5 vertical feet above the toe of the dam. A 2 1/2 inch P.V.C. pipe connects to the gate valve and runs to a point 150 feet downstream of the dam where it discharges at a point just upstream of a gravel road. The pit housing the gate valve is a steel barrel with lid.

b. Location

The dam is located near the head of small, southerly flowing, intermittant, unnamed stream which approximately 1 mile downstream of the dam joins Hopewell Creek, also an intermittant stream. Hopewell Creek flows into the intermittant Dry Fork one mile downstream and the latter flows southeasterly for some 2 1/2 miles where it feeds into Charette Creek. Charette Creek joins the Missouri River some five miles south of its confluence with Dry Fork. The nearest downstream community is Hopewell, Missouri, approximately one mile south of the dam. The main access to the dam from Warrenton, Missouri is south on Highway No. 47 approximately 8 miles. The dam and lake are located 500 feet west of Highway No. 47. The dam and lake are shown on Treloar Quadrangle Sheet (7.5 minute series) in Section 33, Township 46 North, Range 2 West.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam size category as being "Small" since its storage is less than 1,000 acre-feet. The dam is also classified as "Small" in dam size category because its height is less than 40 feet. The overall size classification is, accordingly, "Small" in size.

d. Hazard Classification

The dam has been classified as having "High" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with the classification. Within one mile downstream from the dam are three houses, one small gravel road, and one county road crossing.

e. Ownership

Aspenhoff Lake Dam is owned by Aspenhoff Trustees. The mailing adress is Aspenhoff Trustees, 40 North Mendica, 3317 Cran St., St. Ann. Missouri, 63383.

f. Purpose of Dam

The purpose of the dam is to impound water for recreational use as a private lake. The lake is utilized by landowners of a development in the surrounding hillsides.

g. Design and Construction History

Aspenhoff Lake Dam was built in 1965 with no formal engineering design. Mr. Herb Zuroweste of Warrenton, MO. and Mr. Russell Bollinger (deceased) were the two contractors on the construction. Mr. Zuroweste remarked that to the best of his knowledge, there were no serious problems with the construction. He also stated that the dam had an adequate core trench which extended to solid material.

h. Normal Operational Procedures

The dam is used to impound water for recreational use. The lake is privately owned and operated by the trustees and landholders of Aspenhoff. It is believed that the reservoir is kept close to full at all times, with the water level controlled by rainfall, runoff, evaporation and uncontrolled spillway. The inspection team is not aware of any operational or water level records which are kept for Aspenhoff Lake.

1.3 Pertinent Data

a. Drainage Area (square miles):	0.33
b. Discharge at Damsite	
Estimated experienced maximum flood (cfs):	15
Estimated ungated spillway capacity at top of dam elevation (cfs):	350
c. Elevation (Feet above MSL)	
Top of dam:	620.5
Spillway crest:	
Service Spillway	617.0 (Assumed)*
Emergency Spillway	NA
Normal Pool	617
Maximum Pool: (PMF)	621.85
d. Reservoir	
Length of maximum pool (Feet)	1200
e. Storage (Acre-Feet)	
Top of dam:	134
Spillway crest:	
Service Spillway	88
Emergency Spillway	NA
Normal Pool:	88
Maximum Pool: (PMF)	163
f. Reservoir Surface (Acres)	
Top of dam:	14.5
Spillway crest:	
Service Spillway	12.0
Emergency Spillway	NA

Normal Pool:	12.0
Maximum Pool: (PMF)	15.0

g. Dam

Type:	Rolled Earthfill
Length:	600 feet
Structural Height:	29.0 feet
Hydraulic Height:	29.0 feet
Top width:	15.0 feet (average)
Side slopes:	
Downstream	1 vertical to 3 horizontal
Upstream	Unknown
Zoning:	Unknown
Impervious core:	Unknown
Cutoff:	Unknown
Grout curtain:	Unknown

h. Diversion and Regulating Tunnel None

i. Spillway

Type:	Overflow
Service Spillway	Concrete and grassed channel
Emergency Spillway	NA
Length of weir: (Feet)	
Service Spillway	3
Emergency Spillway	NA
Crest Elevation (feet above MSL):	
Service Spillway	617 (Assumed)*
Emergency Spillway	NA

j. Regulating Outlets

Type:	2 1/2 inch diameter galvanized steel pipe
Length:	150 feet ±
Closure:	2 1/2 inch diameter cast iron gate valve
Maximum Capacity:	0.25 cfs

* Elevation w.r.t. MSL is assumed from the U.S.G.S. Quadrangle Topographic Map

SECTION 2 : ENGINEERING DATA

2.1 Design

No design data is available for the dam and appurtenant structures.

2.2 Construction

The dam was built by Mr. Russell Bollinger (deceased) of Wright City. No data is available relative to the construction of the dam.

2.3 Operation

The inspection team is not aware of any operational records or data available for Aspenhoff Lake Dam. It is our belief that no records are kept.

2.4 Evaluation

a. Availability

No design drawings, design computations, construction data, or operation data is available.

In addition, no pertinent data was available for review of hydrology spillway capacity, flood routing through the reservoir, outlet capacity, slope stability, seepage analysis, or foundation conditions.

b. Adequacy

The lack of engineering data did not allow for a definitive review and evaluation. Therefore, the adequacy of the hydraulic and hydrologic capabilities of this dam could not be assessed from the standpoint of reviewing and evaluating design, operation and construction data, but is based primarily on visual inspection, field measurements, past performance history, and sound engineering judgment.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were also not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

No valid engineering data is available.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Aspenhoff Lake Dam was made on May 15, 1979. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Dr. M.A. Samad	Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
Jon Diebel	Engineering Consultants, Inc.	Structural and Mechanical
Peter Strauss	Engineering Consultants, Inc.	Soils
Peter Howard	Engineering Consultants, Inc.	Geology
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil and Structural

Specific observations are discussed below.

b. Dam

The crest and downstream slope of the dam has a heavy grass cover which provides a certain degree of protection for the embankment material against surface erosion. Inspection of the downstream slope showed many shallow rain gullies. These were probably formed before the grass cover and appear to be stable.

The upstream slope has no riprap protection and has consequently undergone minor erosion from wave action. No trees or brush were growing on the embankment. Minor rodent activity was observed on the upstream embankment slope.

No evidence of any instability or sloughing was seen on the embankment, nor was seepage observed at any location.

Several formations are exposed in the vicinity of Aspenhoff Lake Dam. Underlying the dam and reservoir is the Jefferson City Dolomite, Ordivician in age. This formation consists predominately of dolomite but also contains shales, cherts, and sandstone. The shales occur generally as thin partings in the other beds. The cherts are usually associated with the sandstone. It is not known if a core trench has been constructed under the embankment to this bedrock.

Overlying Jefferson City Dolomite is the St. Peter Sandstone (Ordivician). The St. Peter Sandstone is well exposed about 10 feet above and 100 feet to the east of the left abutment of the dam. The Jefferson City is not well

exposed at the site and, in the valley below the dam, a residual soil has developed by the weathering of the formation.

According to the U.S.D.A. Soil Conservation Service (Soil Survey of Montgomery and Warren Counties, Missouri, 1978) the soils consist of silty sands (SM), gravels (GM), and gravelly clay (GC) in the bottom land at the damsite. On the lower slopes, the soils are reported to be silty clay (CL-ML), clay (CL), and sandy clay (SC).

c. Appurtenant Structures

(1) Spillway

The concrete pad in the spillway channel did not demonstrate significant cracking or erosion. However, a joint about 1/8-inch wide, between the pad and the vertical wall at the drop is open, which allows water to flow behind the vertical wall. The saturation of the soils behind this vertical wall was demonstrated by wet areas which appear on the banks of the spillway channel on each side of the concrete wall. Voids were also observed behind the concrete wall on each side of the channel. These voids were caused by a combination of surface flows through the spillway channel and sloughing of the saturated soils.

The spillway discharge channel demonstrated substantial eroding and sloughing. The banks of the channel are mostly unprotected, and are much steeper than the friction angle of the soil used in the banks. The unstable banks were observed along the entire length of the channel from the drop just downstream of the spillway to the end of the channel at the downstream toe of the dam. This condition is especially

serious just downstream of the concrete pad where the erosion is threatening the embankment materials.

(2) Outlet Works

The low level drain outlet appeared to be in satisfactory condition. The gate valve was protected in a pit, and the 2 1/2 inch diameter polyvinyl chloride pipe served to carry discharge well downstream of the embankment fill. The gate valve was opened during the field inspection and water flowed through the system.

d. Reservoir Area

The water surface elevation was 617.0 feet above MSL at the time of inspection.

The reservoir is gently sloping with trees and woods near the shore. No evidence of any instability was observed. Some small houses are constructed in the hillside bordering the reservoir area.

e. Downstream Channel

The channel downstream from the spillway crest is an earthcut channel. The banks of the channel are steep. Riprap has been placed in some areas of the channel. The discharge from the channel flows through a culvert underneath a road downstream of the dam. The channel downstream from the culvert is a natural channel with heavy vegetative growth. No major erosion was observed in this channel.

3.2 Evaluation

The spillway at Aspenhoff Lake Dam demonstrated several problems which will require remedial measures in the future. These include:

1) the open joint between the concrete pad and the vertical wall at the drop to the spillway discharge channel

2) voids forming behind the vertical concrete wall

3) the eroding and sloughing spillway discharge channel.

Other problems observed at the dam include sloughing of embankment materials and minor rodent activity on the upstream slope of the embankment.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Aspenhoff Lake Dam is used to impound water from rainfall and runoff for recreation. Normally, the lake is allowed to remain as full as possible.

4.2 Maintenance of Dam

The dam is maintained by several trustees and land owners. On the day of the inspection it appeared that the crest and slopes have received care and maintenance.

There appears to be a problem with erosion through the spillway channel and also around the wall at the end of the spillway. Rock has been dumped along the left side of the spillway channel to arrest the erosion and undercutting which is working its way toward the gravel road at the left abutment and towards the right abutment of the dam.

The upstream surface of the dam at the water level seems to be rather erratic and partially eroded. Minor rodent activity was noticed on the upstream face.

The inspection team is not aware of any maintenance records which are kept for the dam and appurtenant structures.

4.3 Maintenance of Operating Facilities

Approximately 285 feet from the right abutment on the downstream side is a vertically mounted steel drum which encases a 2-1/2 inch gate valve which is operable and in good condition. This valve along with a 2-1/2 inch PVC pipe (which leads downstream) constitute the low level outlet works. There are no records kept pertaining to the operating facilities.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any existing warning system for this dam.

4.5 Evaluation

It would appear that attempts are being made to maintain the dam and its surrounding reservoir area. However, the eroding spillway channel and the deteriorating condition of the spillway should be corrected within a reasonable period of time.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The watershed area of the Aspenhoff Lake Dam upstream from the dam axis consists of approximately 209 acres. Most of the watershed area is wooded and covered with grass. Land gradients in the higher regions of the watershed average roughly 25 percent, and in the lower areas surrounding the reservoir average about 8 percent. The Aspenhoff Lake Reservoir is located on an unnamed tributary of Hopewell Creek. The reservoir is about one mile upstream from the confluence of the unnamed tributary and Hopewell Creek. At its longest arm the watershed is approximately 1 mile long. A drainage map showing the watershed area is presented as Plate 1 in Appendix B.

Evaluation of the hydraulic and hydrologic features of Aspenhoff Lake Dam was based on criteria set forth in the Corps of Engineers' "Recommended Guidelines for Safety Inspection of Dams", and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on criteria given in EM 1110-2-1411 (Standard Project Storm). The SCS method was adopted for deriving the unit hydrograph, utilizing the Corps of Engineers' computer program HEC-1, (Dam Safety Version).

The unit hydrograph parameters are presented in Appendix B. The SCS method was also used for determining loss rate. The hydrologic soil group of the watershed was determined by use of published soil maps. The hydrologic soil group of the watershed and the SCS curve number are also presented in Appendix B. The curve number, unit hydrograph parameters, PMP index rainfall and the percentages for various durations were directly input to the HEC-1 (Dam Safety Version) computer program to obtain the PMF hydrograph. The computed peak discharge of the PMF and one-half of the PMF are 4,247 cfs and 2,124 cfs respectively.

Both the PMF and one-half of the PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method also utilizing the HEC-1 (Dam Safety Version) computer program. The reservoir was assumed at the spillway crest level at the start of routing computation. The peak outflow discharges for the PMF and one-half of the PMF are 3,601 and 1,609 cfs respectively. Both the PMF and one-half of the PMF, when routed through the reservoir result in overtopping of the dam.

The stage-outflow relation for the spillway was prepared from field notes, and sketches, prepared during the field inspection. The reservoir stage-capacity data were based on the U.S.G.S. Treloar Quadrangle Topographic Map (7.5 minute series). In the routing computations, the discharge through the outlet facilities was excluded due to its insignificant magnitude as compared to the spillway discharge and the PMF. The spillway and overtop rating curve and the reservoir capacity curve are presented in Plates 2 & 3 respectively in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam aims at avoiding overtopping. Overtopping is especially dangerous for an earth dam because the downrush of waters over the crest will erode the dam embankment and release all the stored water suddenly into the downstream floodplain. The safe hydrologic design of a dam requires a spillway discharge capability, in combination with an embankment crest height that can handle a very large and exceedingly rare flood without overtopping.

The Corps of Engineer designs its dams to safely pass the Probable Maximum Flood that is estimated could be generated from the upstream watershed. This is the generally accepted criterion for major dams throughout the world, and is the standard for dam safety where overtopping would pose any threat to human life. According to the Corps criteria, the hydrologic requirement for safety for this dam is the capability to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, according to the representative of the owner, the maximum reservoir level was about 6 inches above the crest of the spillway.

c. Visual Observations

Observations made of the spillway during the visual inspection are discussed in Section 3.1c(1) and evaluated in Section 3.2.

d. Overtopping Potential

As indicated in Section 5.1-a, both the Probable Maximum Flood and one-half of the Probable Maximum Flood, when routed through the reservoir, resulted in overtopping of the dam. The peak outflow discharges for the PMF and one-half of the PMF are 3,601 and 1,609 cfs respectively. The PMF overtopped the dam crest by 1.35 feet and one-half of the PMF overtopped the dam crest by 0.68 feet, respectively. The total duration of embankment overflow is 5.08 hours during the PMF, and 1.75 hours during one-half of the PMF. The spillway for Aspenhoff Lake Dam is capable of passing a flood equal to approximately 22 percent of the PMF just before overtopping the dam.

The computed one percent chance flood using 100-year, 24 hour rainfall data was routed through the reservoir. The routing results indicate the spillway will pass the 100-year flood with a freeboard of 0.43 feet.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. There are three dwellings, one small gravel road, and one county road crossing within about a mile downstream from the dam.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlement or distress observed on the embankment during the visual inspection. The entire exposed surface of the dam are covered with grass.

The upstream slope of the embankment near the crest does not contain riprap protection and has undergone some wave erosion. This condition does not appear to be serious at this time, but should be watched in the future for further erosion, and repairs made as required. The rodent activity on the embankment should be eliminated.

The spillway discharge channel located near the left abutment of the dam is separated from the embankment by a narrow ridge of residual soil. Operation of the spillway and seepage under the slab has caused erosion around the sides of the downstream end of the spillway slab. The erosion of the right bank downstream of the concrete slab is cutting into the narrow ridge of natural ground separating the spillway from the embankment. If this condition is allowed to continue, erosion of the embankment materials will result.

Other observations made at the spillway include the open joint between the concrete pad and the vertical wall and the voids forming behind the concrete wall.

b. Design and Construction Data

No design or construction data relating to the structural stability of the dam or appurtenant structures were found.

c. Operating Records

No operating records are available relating to the stability of the dam or appurtenant structures. Water levels have not been recorded, however, the reservoir was full on the day of inspection, and is assumed to be close to full at all time.

d. Post Construction Changes

No post construction changes are known to exist which will effect the structural stability of the dam.

e. Seismic Stability

According to the Seismic Zone Map of Contiguous States, Form TM 5-809-10/NAVFAC P-355/AFM 88-3 Chapter 13, April 1973, the portion of Missouri in which Aspenhoff Lake Dam is located is in Seismic Zone 2. This means there is only moderate damage probability. A detailed seismic analysis is not felt to be necessary for this embankment under present conditions. If a stability analysis is to be performed, the seismic coefficient recommended is 0.05.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Aspenhoff Lake Dam was found to be "Seriously Inadequate". The spillway and the reservoir system will accommodate only 22 percent of the PMF without overtopping the dam.

The embankment appears to be in generally good condition. The erosion on the upstream embankment slope due to wave action should be watched and repairs made to the slope as required. Rodents should be eliminated from the embankment.

Continued erosion at the right side of the spillway could break through the thin ridge separating the spillway from the left abutment of the dam and extend into the left abutment of the dam. This would be a potentially hazardous condition. The banks of the spillway channel should be stabilized throughout its entire length to prevent further erosion.

b. Adequacy of Information

Information concerning the dam and appurtenant structures is not available. It is recommended that the following programs be initiated to help alleviate this problem:

1. Periodic inspection of the dam by an engineer experienced in the design and construction of earthen dams should be made and this inspection report made a matter of record.

2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. Perform seepage and stability analyses comparable to the "Recommended Guidelines for Safety Inspection of Dams".

c. Urgency

A program should be developed as soon as possible to monitor at regular intervals the deficiencies described in this report. The remedial measures recommended in paragraph 7.2 should be accomplished in the near future. The item recommended in paragraph 7.2.a should be pursued on a high priority basis.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, and if the remedial measures recommended in Paragraph 7.2 are undertaken as soon as possible, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives:

Spillway capacity and/or height of dam should be increased to pass one-half of the PMF without overtopping the dam.

b. O & M Procedures:

1. Stabilize the banks of the spillway discharge channel to prevent future erosion and sloughing.

2. Improve the condition of the concrete spillway structure by repairing the crack between the concrete pad and the vertical wall and filling the voids behind the wall. Additional modifications to the concrete slab and vertical wall may be necessary to insure a stable spillway structure.

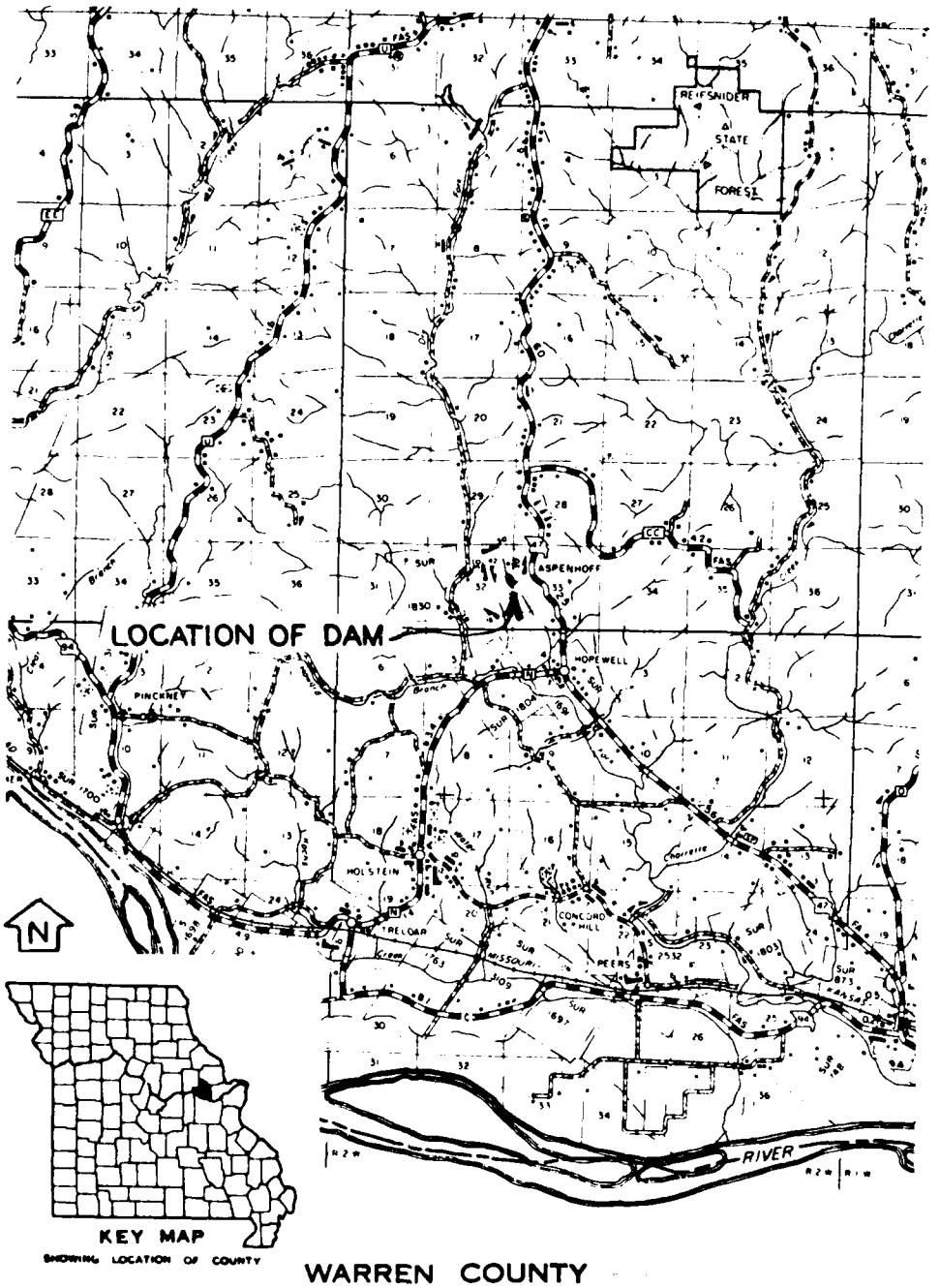
3. Rodents should be eliminated from the embankment.

4. The owner should initiate the following programs.

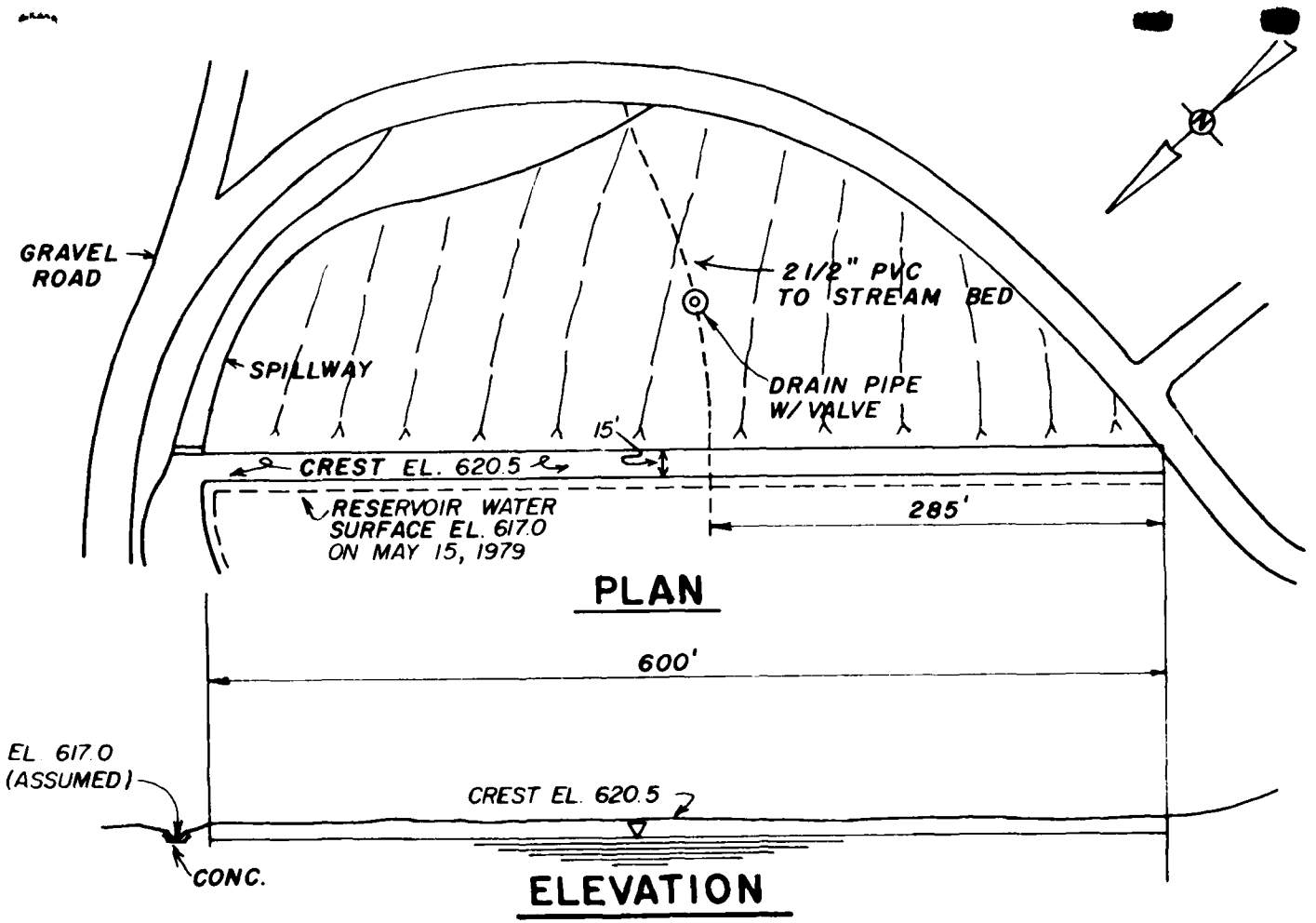
   (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earthen dams.

   (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

PLATES

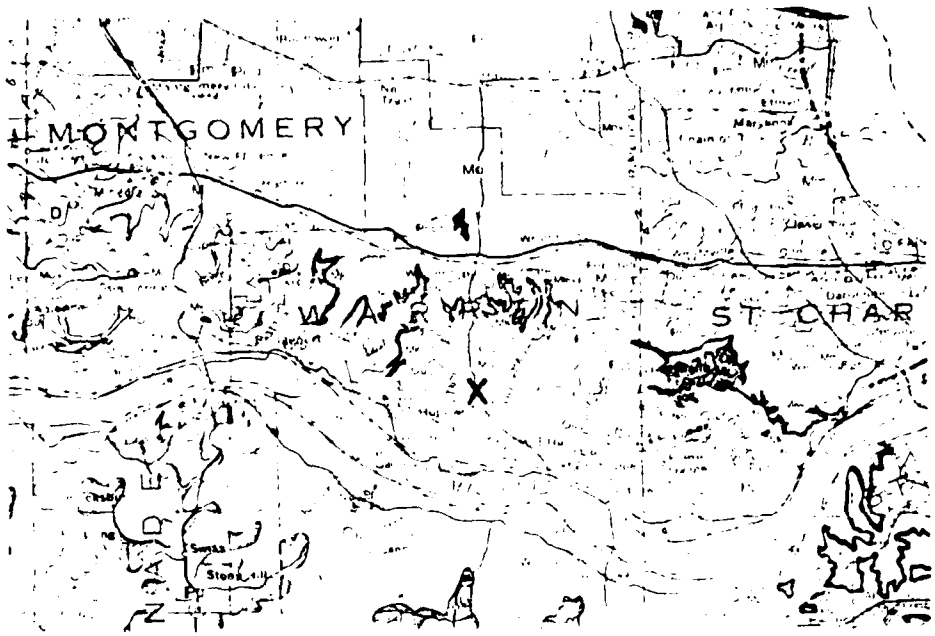


LOCATION MAP - ASPENHOFF LAKE DAM



ASPENHOFF LAKE DAM
PLAN & ELEVATIONS

SCALE:
1" = 100' (HORIZONTAL)
VERTICAL (NOT TO SCALE)



QUARTERNARY { Qal - ALLUVIUM

PENNSYLVANIAN { Pm - MARMATON GROUP
Pcc - CHEROKEE GROUP

MISSISSIPPIAN { Mm - ST LOUIS LIMESTONE
SALEM FORMATION
WARSAW FORMATION
Mo - BURLINGTON-KEOKUK FORMATION
Mk - CHOTEAU GROUP

ORDOVICIAN { Ou - NOIX LIMESTONE
MAQUOKETA SHALE
CAPE LIMESTONE
KIMMSWICK FORMATION
DECORAH FORMATION
PLATTIN FORMATION
JOACHIM DOLOMITE

Osp-ST PETER SANDSTONE

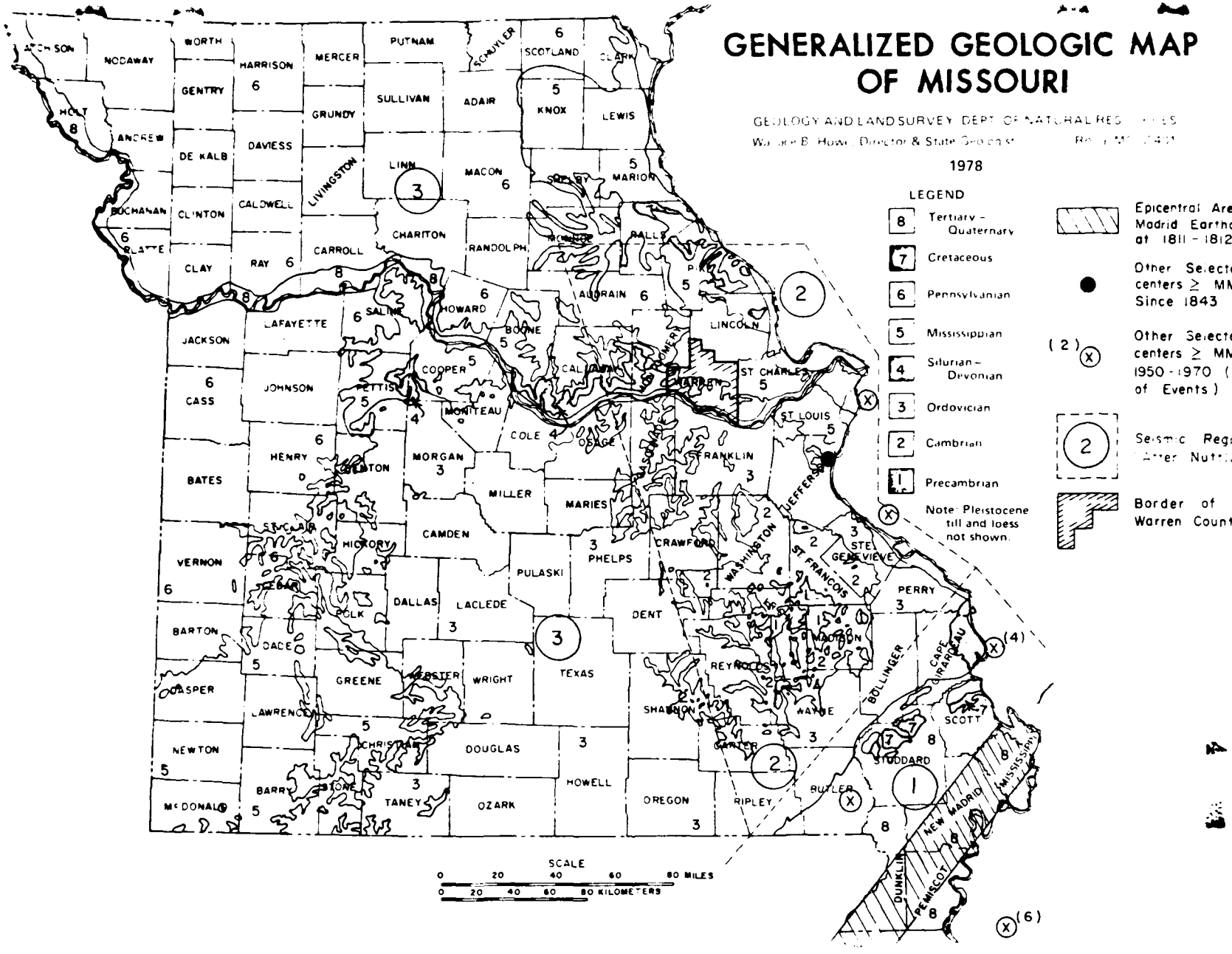
Ojc-COTTER-POWELL FORMATION
JEFFERSON CITY DOLOMITE

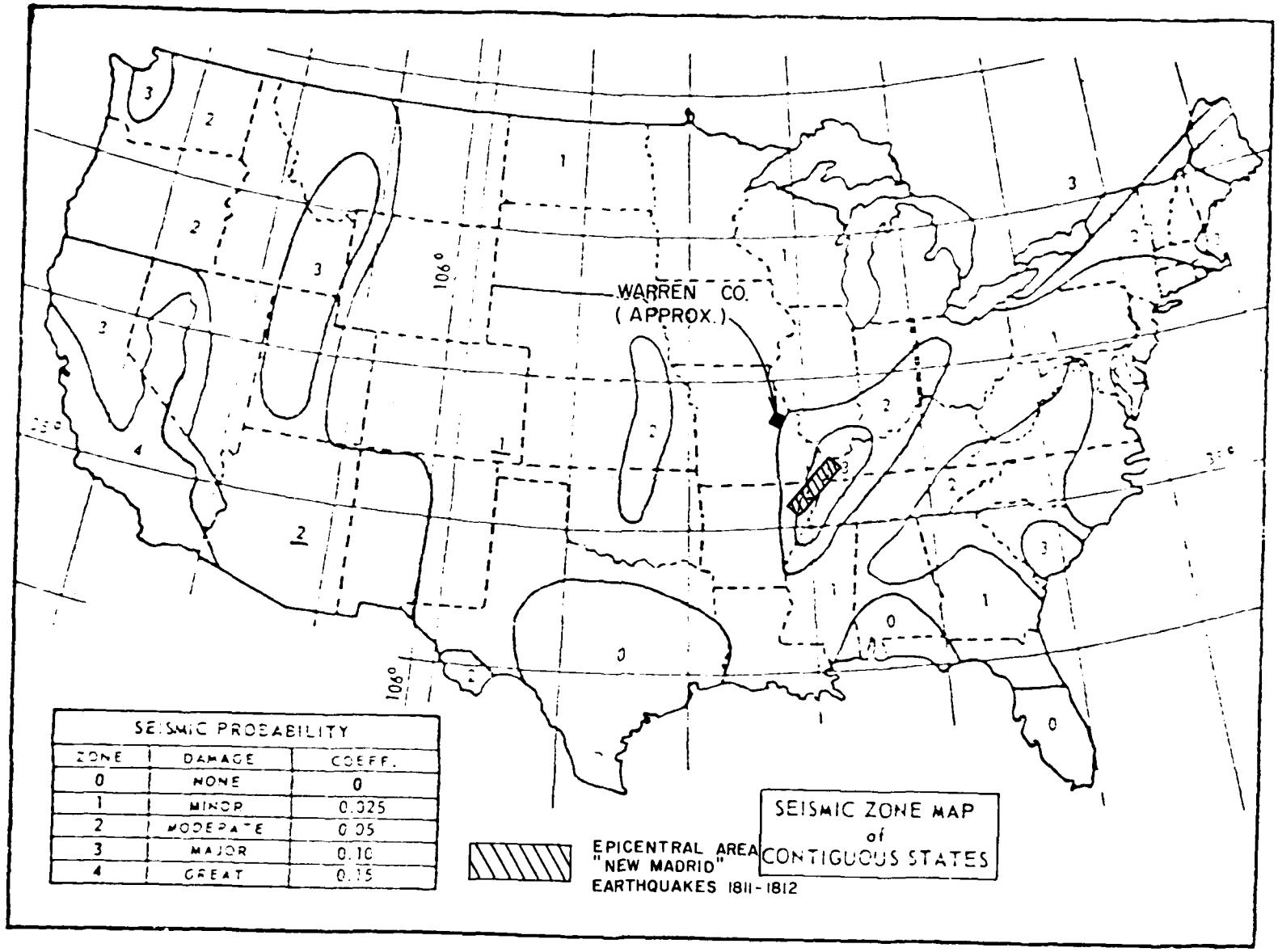
X LOCATION OF DAM MO 11006

REFERENCE
GEOLOGIC MAP OF MISSOURI, MISSOURI GEOLOGIC SURVEY, 1979.

10 0 10
SCALE OF MILES

GEOLOGIC MAP OF WARREN COUNTY AND ADJACENT AREA


GENERALIZED GEOLOGIC MAP OF MISSOURI
GEOLOGY AND LAND SURVEY DEPT. OF NATURAL RESOURCES
1978
LEGEND
8 Tertiary - Quaternary
7 Cretaceous
6 Pennsylvanian
5 Mississippian
4 Silurian - Devonian
3 Ordovician
2 Cambrian
1 Precambrian
Note: Pleistocene till and loess not shown.
Epicentral Area, New Madrid Earthquakes at 1811 - 1812
Other Selected Ep centers ≥ MM VI Since 1843
Other Selected Ep centers ≥ MM V 1950 - 1970 (Numb of Events)
Seismic Region
Border of Warren County
SCALE
0 20 40 60 80 MILES
0 20 40 60 80 KILOMETERS
ATCHISON
NODAWAY
WORTH
HARRISON
MERCER
PUTNAM
SCHUYLER
SCOTLAND
CLARK
GENTRY
GRUNDY
SULLIVAN
ADAIR
KNOX
LEWIS
HOLT
ANDREW
DE KALB
DAVIESS
LIVINGSTON
LINN
MACON
SHELBY
MARION
BUCHANAN
CLINTON
CALDWELL
CHARITON
RANDOLPH
MONROE
PIKE
PLATTE
CLAY
RAY
CARROLL
HOWARD
AUDRAIN
LINCOLN
JACKSON
LAFAYETTE
SALINE
BOONE
COOPER
CALLAWAY
MONTGOMERY
WARREN
ST CHARLES
CASS
JOHNSON
PETTIS
MONITEAU
COLE
OSAGE
ST LOUIS
HENRY
BENTON
MORGAN
FRANKLIN
JEFFERSON
BATES
MILLER
MARIES
CAMDEN
CRAWFORD
WASHINGTON
ST GENEVIEVE
ST CLAIR
HICKORY
VERNON
PULASKI
PHELPS
ST FRANCOIS
PERRY
CEDAR
POLK
DALLAS
LACLEDE
DENT
BARTON
DADE
MADISON
CAPE GIRARDEAU
BOLLINGER
JASPER
GREENE
WEBSTER
WRIGHT
TEXAS
REYNOLDS
SHANNON
WAYNE
SCOTT
LAWRENCE
CHRISTIAN
DOUGLAS
CARTER
STODDARD
NEWTON
BARRY
STONE
TANEY
OZARK
HOWELL
OREGON
RIPLEY
BUTLER
NEW MADRID
MISSISSIPPI
McDONALD
DUNKLIN
PEMISCOT
(2)
(4)
(6)


WARREN CO.
(APPROX.)
106°
106°
35°
35°
SEISMIC PROBABILITY
ZONE | DAMAGE | COEFF.
0 | NONE | 0
1 | MINOR | 0.025
2 | MODERATE | 0.05
3 | MAJOR | 0.10
4 | GREAT | 0.15
EPICENTRAL AREA "NEW MADRID" EARTHQUAKES 1811-1812
SEISMIC ZONE MAP of CONTIGUOUS STATES

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

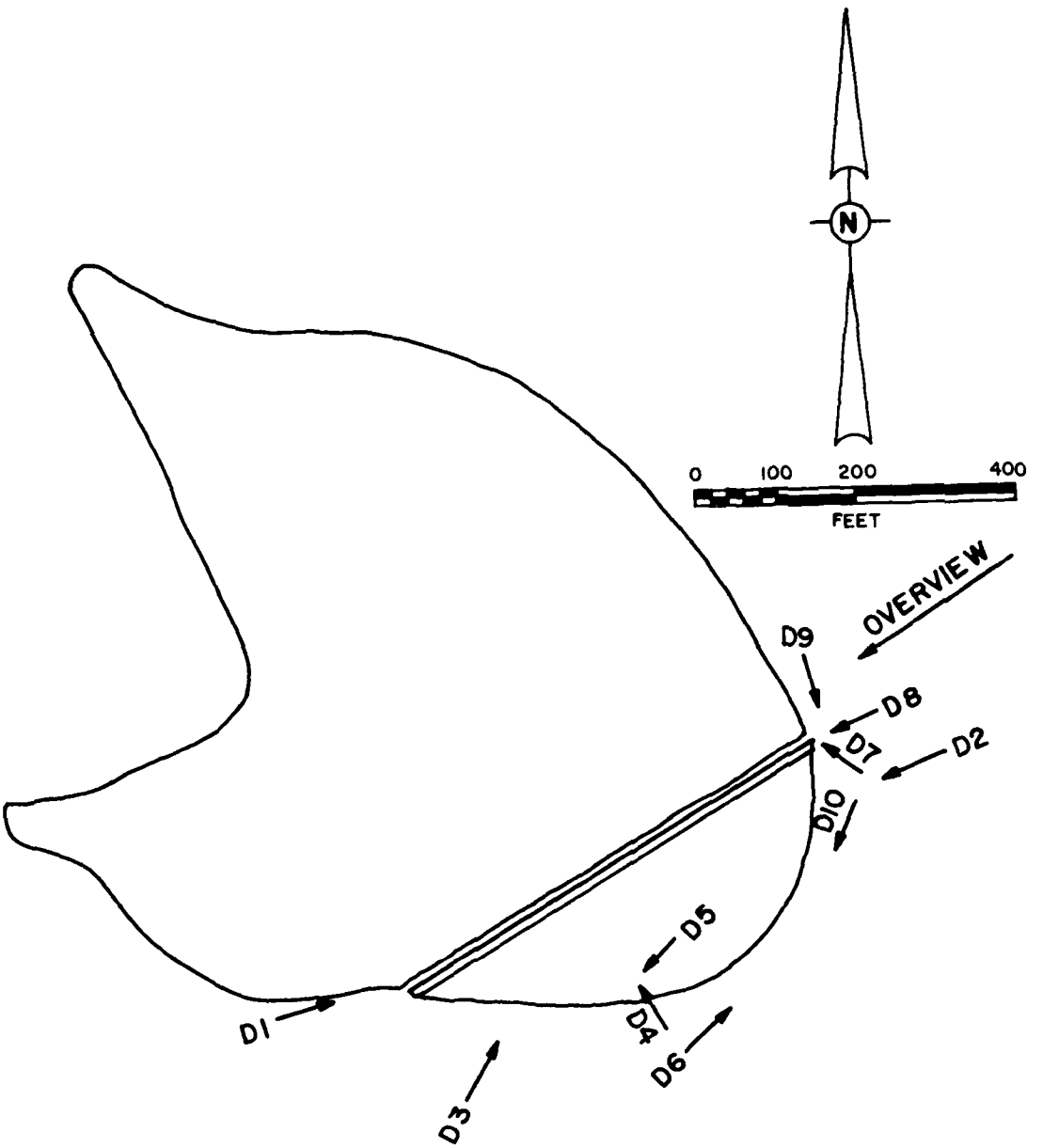


PHOTO INDEX
FOR
ASPENHOFF LAKE DAM

ASPENHOFF LAKE DAM

D1 - Crest and Upstream Embankment Slope

D2 - Downstream Embankment Slope

D3 - Downstream Embankment Slope

D4 - Outlet Works Pit and Pipe

D5 - Pit Housing Gate Valve

D6 - Concrete Pad Downstream of Road

D7 - Spillway Crest

D8 - Void Under Concrete Spillway Pad

D9 - Spillway Discharge Channel

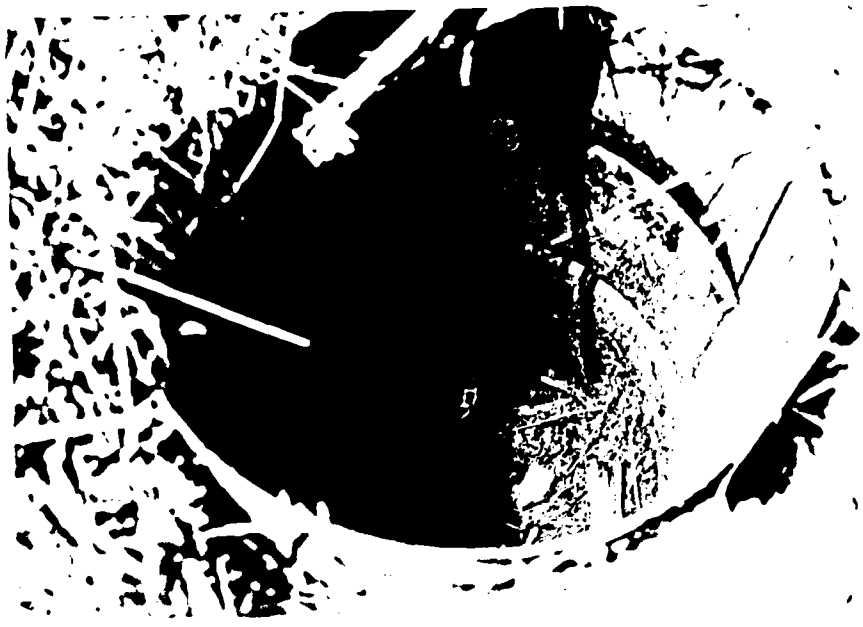
D10 - Spillway Discharge Channel

D1

D2

D3

D4



D5

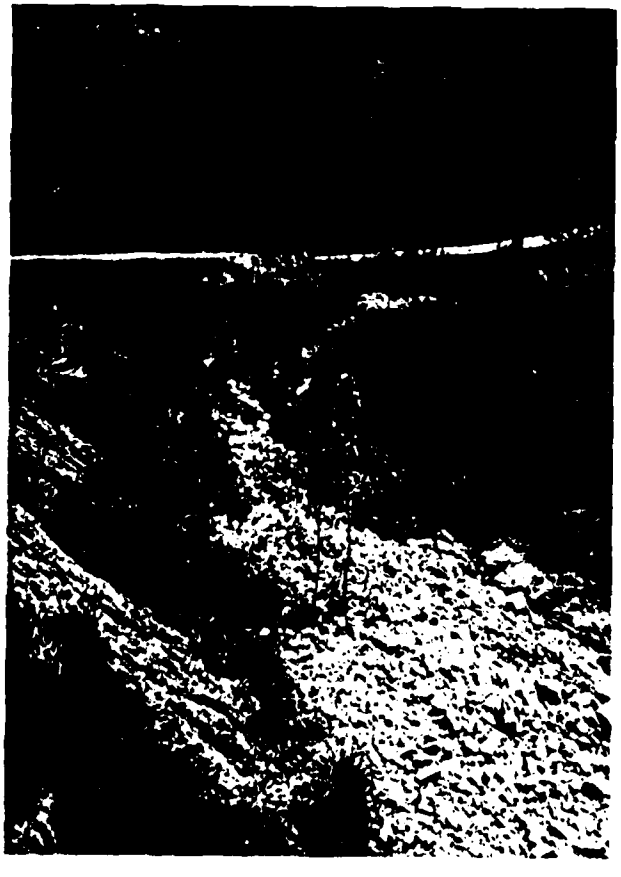
D6

D7

D8

Aspenbott Lake Dam

09



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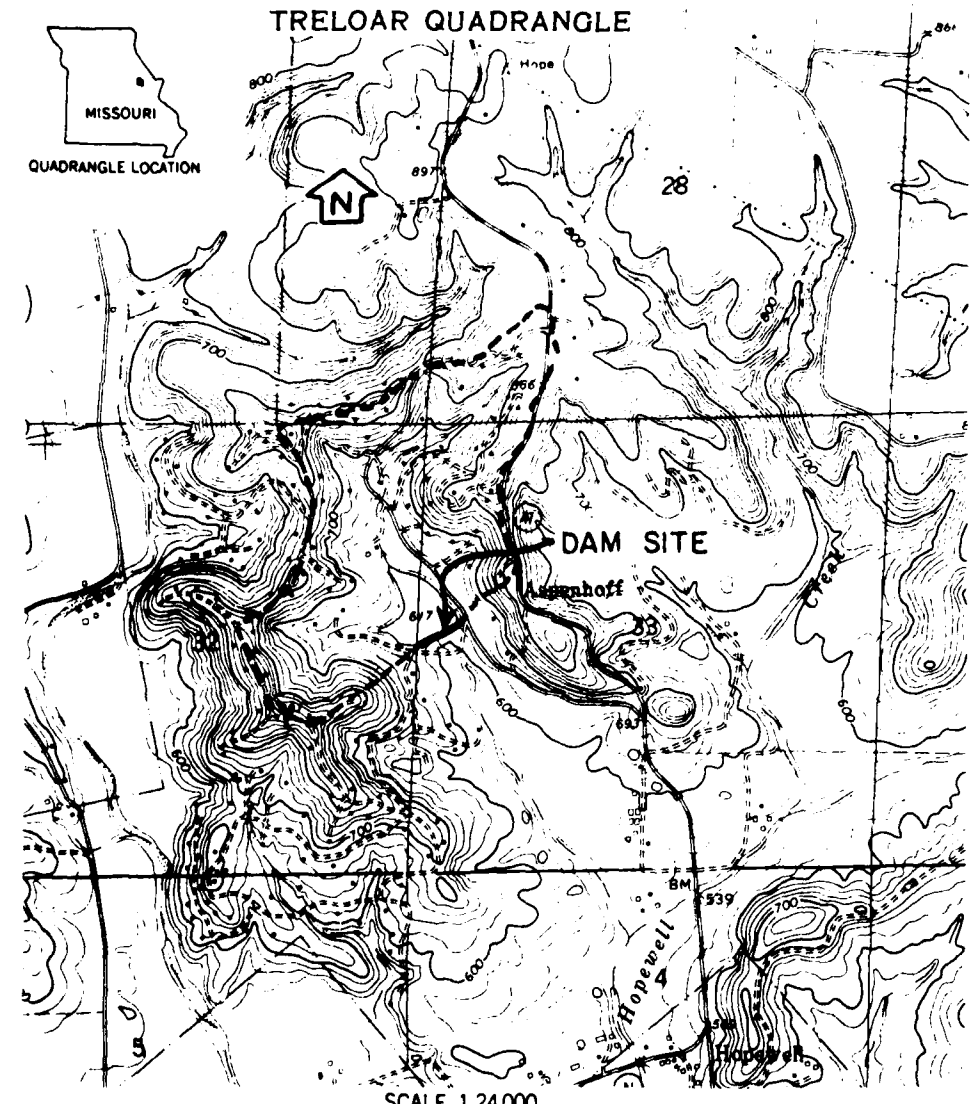
APPENDIX B

HYDROLOGIC COMPUTATIONS

PLATE-1, APPENDIX B



ASPENHOFF LAKE DAM (MO.11006)
DRAINAGE BASIN

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI

ASPENHOFF LAKE DAM (MO. 11006)

SPILLWAY AND OVERTOP DISCHARGE CAPACITY CURVE

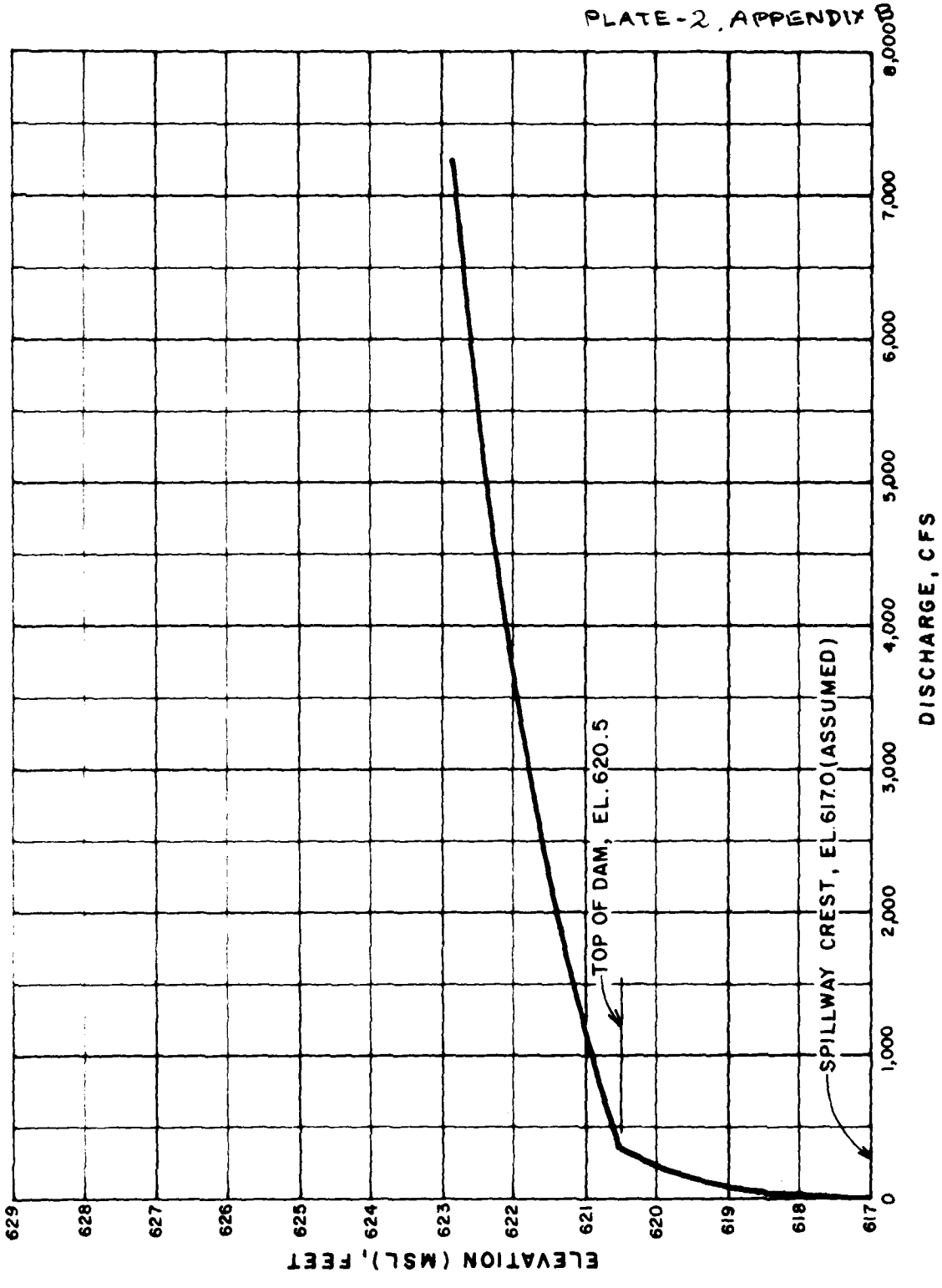
SHEET NO. 1 OF ____

JOB NO. 1240-001-1

BY KLB/DMAS DATE 5-21-79

Y_{c_1} (FT)	T_{c_1} (FT)	A_{c_1} (FT²)	$V_{c_1} = \sqrt{\frac{Ag}{T_{c_1}}}$	$\frac{V_{c_1}^2}{2g}$	$Q_{c_1} = A_{c_1} V_{c_1}$ (CFS)	WS ELEV. $= 617 + Y_{c_1} + \frac{V_{c_1}^2}{2g}$	H_2 (FT)	C_2	L_2	$Q_2 = C_2 L_2 H_2^{3/2}$	$Q_T = Q_{c_1} + Q_2$ (CFS)
0	0	0	0	0	0	617	-	-	-	-	0
0.75	110	4.88	3.96	0.24	19.	617.99	-	-	-	-	19
1.75	2309	21.43	5.46	0.46	117.	619.21	-	-	+	-	117
2.00	26.36	27.61	5.80	0.52	160	619.52	-	-	+	-	160
2.50	32.91	42.43	6.44	0.64	273	620.14	-	-	+	-	273
2.75	36.18	51.06	6.74	0.71	344	620.46	-	-	+	-	344
3.50	46.00	81.88	7.56	0.89	619	621.39	.89	2.64	640	-	619
4.50	46.00	127.88	9.45	1.39	1208	622.89	2.39	2.63	640	-	1208
											1374
											6025

PLATE-2, APPENDIX B



ASPENHOFF LAKE DAM (MO. 11006)
SPILLWAY & OVERTOP RATING CURVE

ECI-4 ENGINEERING CONSULTANTS, INC.

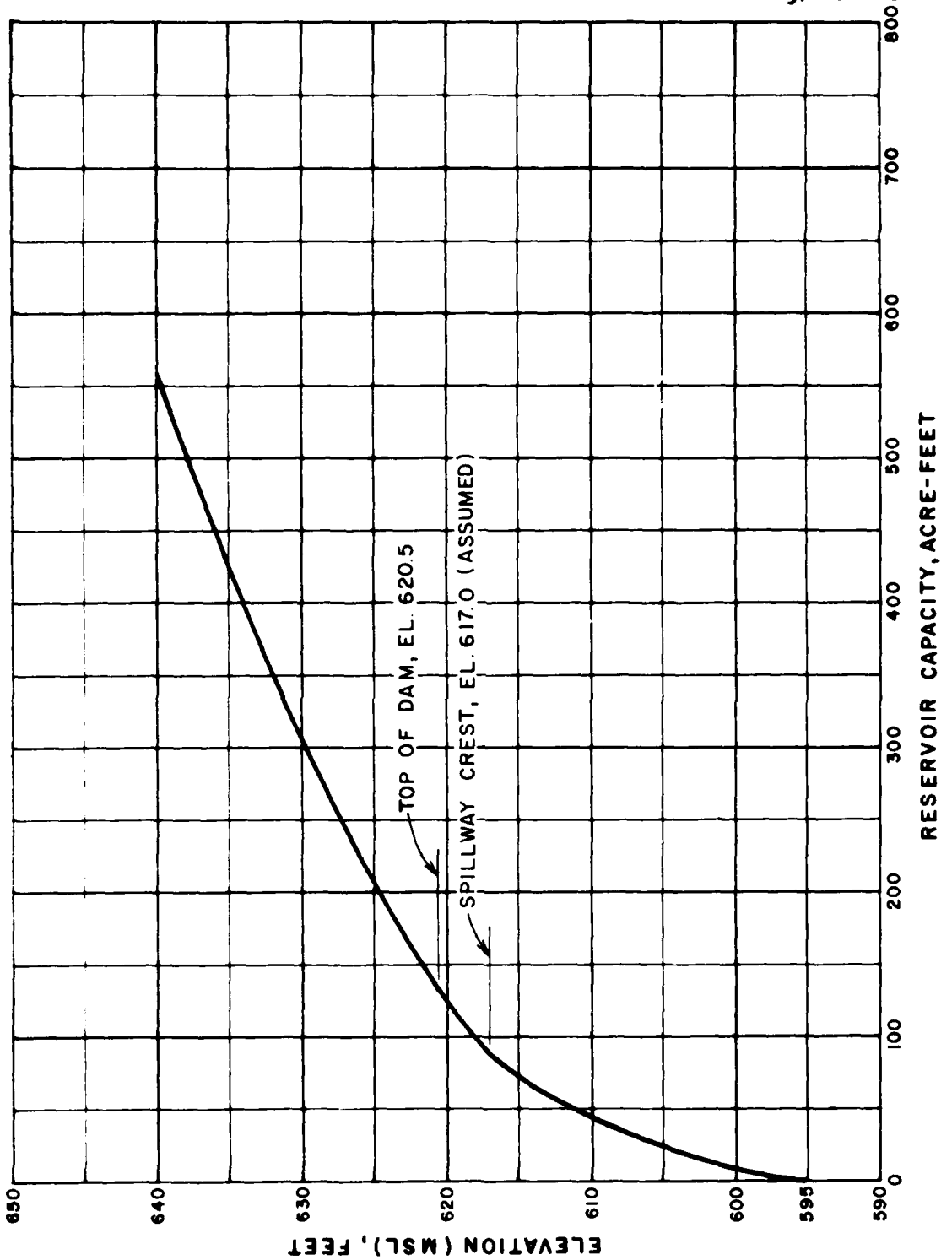
Dam Safety Inspection - Missouri SHEET NO. 1 OF 2
Aspenhoff Lake Dam (MO 11006) JOB NO. 1240-061
Reservoir Area Capacity BY M.R.H. DATE 5-15-79
V.MAG

Aspenhoff Lake Dam

Reservoir Area Capacity

Elev. M.S.L. (Ft.)	Reservoir Surface Area (Acres)	Incremental Volume (Ac.-Ft.)	Total Volume (Ac.-Ft.)	Remarks
595	0	-	0	Est. Streambed Upstream of Dam
617	12	88	88	Water Surface as shown on Quadrangle (Assumed at Spillway Crest)
620	14	39	127	
620.5	145	7	134	Crest El. of Dam
640	30	425	559	

PLATE-3, APPENDIX-B



ASPENHOFF LAKE DAM (MO. 11006)
RESERVOIR CAPACITY CURVE

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF 3
ASPENHOFF LAKE DAM (MO. 11006) — JOB NO. 1240-001
PROBABLE MAXIMUM PRECIPITATION — BY MAS DATE 5/22/79

DAM NO. MO. 11006

DETERMINATION OF PMP

1. Determine drainage area of the basin

   D.A. = 209 Acres

2. Determine PMP Index Rainfall (For D.A = 200 sq. mi. & 24 hrs duration)

   Location of centroid of basin

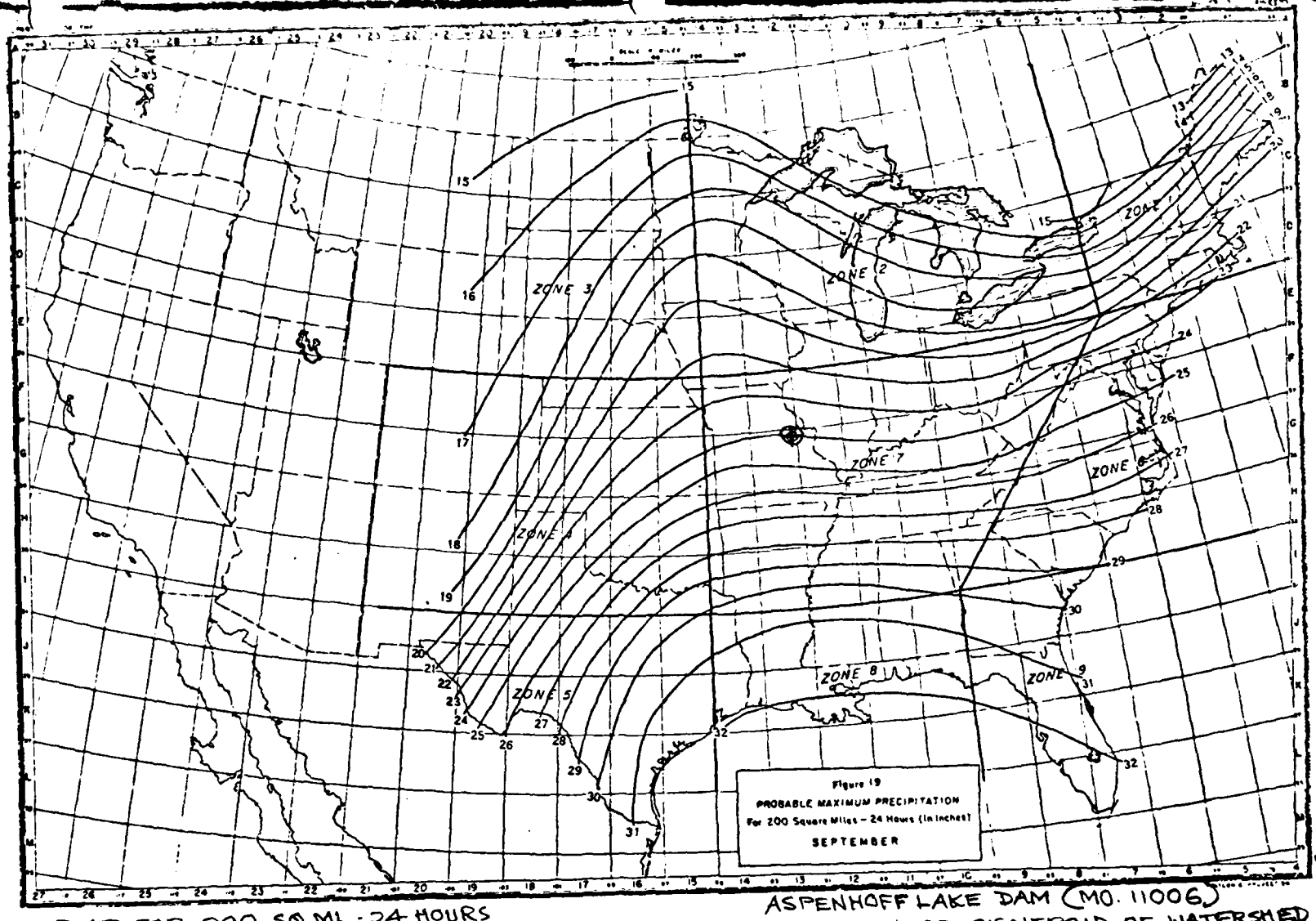
   Long. = 91°9'2", Lat. = 38°42'23" ⇒ PMP = 24" (From Fig 1 HMR 33)

3. Determine basin rainfall interms of percentage of PMP Index Rainfall for various durations.

   Location: Long. = 91°9'2", Lat. = 38°42'23"

   → Zone 7

Duration (Hrs.)	Percent of Index Rainfall (%)	Total Rainfall (inches)	Rainfall Increments (inches)	Duration of Increment (Hrs.)
6	100	24	24	6
12	120	28.8	4.8	6
24	130	31.2	2.4	12



PMP FOR 200 SQ. MI. - 24 HOURS
DURATION = 24"

ASPENHOFF LAKE DAM (MO. 11006)
LOCATION OF CENTROID OF WATERSHED
LAT. = 38° 42' 23", LONG. = 91° 9' 2"

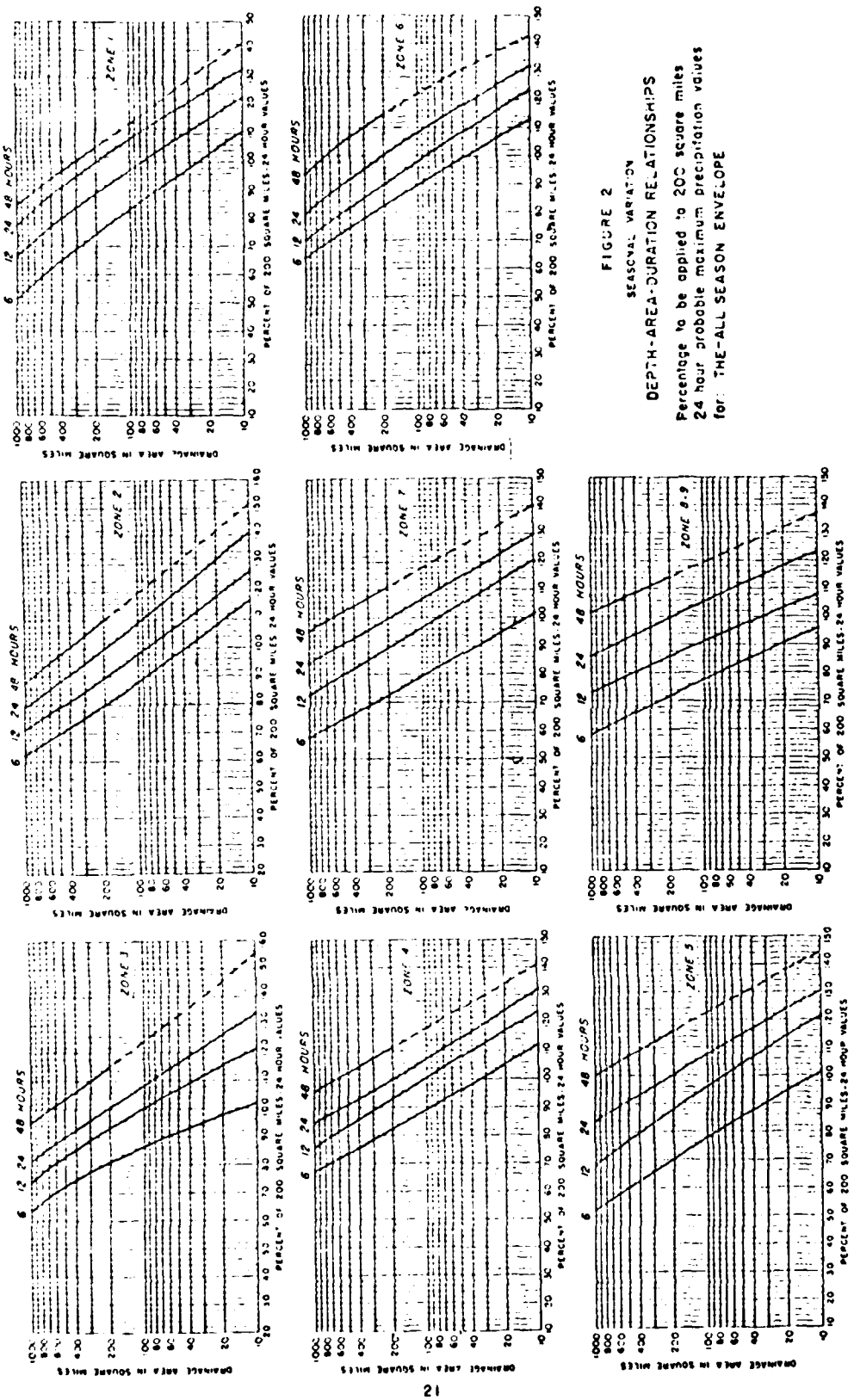


FIGURE 2

SEASONAL VARIATION

DEPTH-AREA-DURATION RELATIONSHIPS

Percentage to be applied to 200 square miles 24 hour probable maximum precipitation values for THE-ALL SEASON ENVELOPE

ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF
DAM # MO. 11006 — JOB NO. 1240-001
HYDROLOGIC SOIL GROUP & CURVE NUMBER — BY MAS — DATE 5/30/79

MISSOURI DAM # MO 11006

DETERMINATION OF HYDROLOGIC SOIL GROUP AND CURVE NUMBER

1. Watershed Soils consist of B and D group Soils. More than 50% of the watershed consist of B group Soil.
   Assume Soil Group B for the whole watershed.
2. Most of the watershed is wooded and covered with grass. Assume ~~hydrologic~~ condition of the watershed as 'Fair'
   Thus CN = 60 for Soil Group B and AMC-II
   $\Rightarrow$ CN = 78 for AMC-III

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - Missouri — SHEET NO. 1 OF 1
ASPENHOFF LAKE DAM (MO. 11006) — JOB NO. 1240-001-1
UNIT HYDROGRAPH PARAMETERS — BY KLB VMAS DATE 5-30-79

1. DRAINAGE AREA, $A = 209\ A_c = 0.33$ SQ. MI.

2. LENGTH OF STREAM = (1.80" × 2000' = 3600') = 0.68 MI

3. ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM, $H_1 = 885$

4. RESERVOIR ELEVATION AT SPILLWAY CREST, $H_2 = 617'$

5. DIFFERENCE IN ELEVATION, $\Delta H = 885 - 617 = 268'$

6. AVERAGE SLOPE OF STREAM = $\frac{\Delta H}{L} = \frac{268'}{3800} = 7.4\%$

7. TIME OF CONCENTRATION:

a) By KIRPICH FORMULA:

$$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385} = \left(\frac{11.9 \times 0.68^3}{268}\right)^{0.385} = 0.19 \text{ HR}$$

b) By VELOCITY ESTIMATE:

SLOPE = 7.4% ⇒ AVG. VELOCITY = 5 FPS

$$\therefore T_c = \frac{0.68 \times 5280}{5 \times 60 \times 60} = 0.20 \text{ HR}$$

USE $T_c = 0.19$ HR.

8. LAG TIME, $L_t = 0.6 \times 0.19 = 0.11$ HR

9. UNIT DURATION $D \leq \frac{L_t}{3} = \frac{0.11}{3} = 0.037 < 0.083$

USE $D = 0.083$ HR = 5 MIN.

10. TIME TO PEAK, $T_p = \frac{D}{2} + L_t = \frac{0.083}{2} + 0.11 = 0.152$ HR

11. PEAK DISCHARGE, $q_p = \frac{484 \cdot A}{T_p} = \frac{484 \cdot (0.33)}{0.152}$

$q_p = 1051$ CFS.

HEC1DB INPUT DATA

```
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
```

```
     1     A
     2     A                              DAM SAFETY INSPECTION - MISSOURI
     3     A                                 ASPENHOFF LAKE DAM (11006)
     4     A                          PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING
     5     B -  300          0         5         0         0         0         1        .0         0         0
     6     J1        5
     7     J         1         2         1
     8     J1     1.0       0.5
     9     K         0     11006                                                 1
    10     K1    INPUT INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT HYDROGRAPH PARAMETERS
    11     M         1         2      0.53                 0.33       1.0
    12     P                24.0       100       120       130
    13     T                                                                  -1     -78.0
    14     J2                -0.11
    15     Y         0                   0         1
    16     K         1     11006                                 2                 1
    17     K1    ROUTE HYDROGRAPH THROUGH ASPENHOFF LAKE DAM
    18     Y                                          1         1
    19     YI        1                                                      -617.0        -1
    20     YH617.00   617.99   619.21   619.52   620.19   620.46   620.60   621.39   622.09
    21     YS    3.0       19.      117.      160.      273.      344.      530.     1993.     7233.
    22     JS     0.      33.      127.      134.      559.
    23     JE   59%.     617.     620.      620.5     640.
    24     J1    617.
    25     J2  620.5
    26     K         99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT 8006
ROUTE HYDROGRAPH TO 11006
END OF NETWORK

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********

RUN DATE = 80/06/07.
TIME = 09:15:26.
```

DAM SAFETY INSPECTION - MISSOURI
ASPENHOFF LAKE DAM (11004)
PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	0	0

JOPER	NAT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1

RTIOS: 1.00 .50

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT LOSS PRECIPITATION AND RTIOS, INPUT SCS UNIT HYDROGRAPH PARAMETERS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
11006	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.33	0.00	.33	1.00	0.000	0	0	

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
1	0	0.00	0.00	1.00	0.00	0.00	.10	-1.00	-78.00	0.00	0.00

CURVE NO = -78.00 WETNESS = -1.00 EFFECT CN = 78.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .11

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

TIME INCREMENT TOO LARGE--(VHQ IS GT LAG/2)

UNIT HYDROGRAPH 9 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .11 VOL= 1.00

						END-OF-PERIOD FLOW						
HO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	HO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	151	.20	.18	.02	460.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.20	.18	.02	463.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.20	.18	.02	465.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.20	.18	.02	467.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	155	.20	.18	.02	469.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	156	.20	.19	.01	472.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.24	.22	.02	494.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	158	.24	.22	.02	535.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.15	159	.24	.22	.02	557.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.24	.22	.02	567.
1.01	.55	11	.01	0.00	.01	0.	1.01	13.25	161	.24	.23	.01	572.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.30	162	.24	.23	.01	575.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.35	163	.24	.23	.01	577.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.40	164	.24	.23	.01	578.
1.01	1.15	15	.01	0.00	.01	0.	1.01	13.45	165	.24	.23	.01	580.
1.01	1.20	16	.01	0.00	.01	0.	1.01	13.50	166	.24	.23	.01	581.
1.01	1.25	17	.01	0.00	.01	0.	1.01	13.55	167	.24	.23	.01	582.
1.01	1.30	18	.01	0.00	.01	0.	1.01	14.00	168	.24	.23	.01	583.
1.01	1.35	19	.01	0.00	.01	0.	1.01	14.05	169	.30	.29	.01	619.
1.01	1.40	20	.01	0.00	.01	0.	1.01	14.10	170	.30	.29	.01	620.
1.01	1.45	21	.01	0.00	.01	0.	1.01	14.15	171	.30	.29	.01	719.
1.01	1.50	22	.01	0.00	.01	0.	1.01	14.20	172	.30	.29	.01	726.
1.01	1.55	23	.01	0.00	.01	0.	1.01	14.25	173	.30	.29	.01	733.
1.01	2.00	24	.01	0.00	.01	0.	1.01	14.30	174	.30	.29	.01	736.
1.01	2.05	25	.01	0.00	.01	0.	1.01	14.35	175	.30	.29	.01	738.
1.01	2.10	26	.01	0.00	.01	0.	1.01	14.40	176	.30	.29	.01	740.
1.01	2.15	27	.01	0.00	.01	0.	1.01	14.45	177	.30	.29	.01	741.
1.01	2.20	28	.01	0.00	.01	0.	1.01	14.50	178	.30	.29	.01	742.
1.01	2.25	29	.01	0.00	.01	0.	1.01	14.55	179	.30	.29	.01	743.
1.01	2.30	30	.01	0.00	.01	0.	1.01	15.00	180	.30	.29	.01	7434
1.01	2.35	31	.01	0.00	.01	0.	1.01	15.05	181	.46	.18	.01	676.
1.01	2.40	32	.01	0.00	.01	0.	1.01	15.10	182	.56	.56	.01	6634
1.01	2.45	33	.01	0.00	.01	0.	1.01	15.15	183	.56	.56	.01	767.
1.01	2.50	34	.01	0.00	.01	0.	1.01	15.20	184	.55	.53	.01	965.
1.01	2.55	35	.01	0.00	.01	0.	1.01	15.25	185	.64	.62	.01	1235.
1.01	3.00	36	.01	0.00	.01	0.	1.01	15.30	186	1.58	1.52	.03	1972.
1.01	3.05	37	.01	0.00	.01	0.	1.01	15.35	187	2.55	2.51	.04	3594.
1.01	3.10	38	.01	0.00	.01	0.	1.01	15.40	188	1.00	.99	.01	4247.
1.01	3.15	39	.01	0.00	.01	0.	1.01	15.45	189	.64	.63	.01	2128.
1.01	3.20	40	.01	0.00	.01	0.	1.01	15.50	190	.55	.54	.01	2235.
1.01	3.25	41	.01	0.00	.01	0.	1.01	15.55	191	.36	.36	.00	1634.
1.01	3.30	42	.01	0.00	.01	0.	1.01	16.00	192	.36	.36	.00	1232.
1.01	3.35	43	.01	.00	.01	0.	1.01	16.05	193	.28	.28	.00	991.
1.01	3.40	44	.01	.00	.01	0.	1.01	16.10	194	.28	.28	.00	833.
1.01	3.45	45	.01	.00	.01	0.	1.01	16.15	195	.28	.28	.00	754.
1.01	3.50	46	.01	.00	.01	1.	1.01	16.20	196	.28	.28	.00	726.
1.01	3.55	47	.01	.00	.01	1.	1.01	16.25	197	.28	.28	.00	714.
1.01	4.00	48	.01	.00	.01	1.	1.01	16.30	198	.28	.28	.00	709.
1.01	4.05	49	.01	.00	.01	2.	1.01	16.35	199	.28	.28	.00	708.
1.01	4.10	50	.01	.00	.01	2.	1.01	16.40	200	.28	.28	.00	708.
1.01	4.15	51	.01	.00	.01	2.	1.01	16.45	201	.28	.28	.00	708.
1.01	4.20	52	.01	.00	.01	2.	1.01	16.50	202	.28	.28	.00	708.
1.01	4.25	53	.01	.00	.01	3.	1.01	16.55	203	.28	.28	.00	708.
1.01	4.30	54	.01	.00	.01	3.	1.01	17.00	204	.28	.28	.00	708.
1.01	4.35	55	.01	.00	.01	3.	1.01	17.05	205	.22	.22	.00	673.
1.01	4.40	56	.01	.00	.01	4.	1.01	17.10	206	.22	.22	.00	611.
							1.01	17.15	207	.22	.22	.00	579.

1.01	4.40	56	.01	.00	.01	4.	1.01	17.10	206	.02	.02	.00	511.
1.01	4.45	57	.01	.00	.01	4.	1.01	17.15	207	.02	.02	.00	519.
1.01	4.50	58	.01	.00	.01	4.	1.01	17.20	208	.02	.02	.00	516.
1.01	4.55	59	.01	.00	.01	4.	1.01	17.25	209	.02	.02	.00	560.
1.01	5.00	60	.01	.00	.01	5.	1.01	17.30	210	.02	.02	.00	558.
1.01	5.05	61	.01	.00	.01	5.	1.01	17.35	211	.02	.02	.00	558.
1.01	5.10	62	.01	.00	.01	5.	1.01	17.40	212	.02	.02	.00	557.
1.01	5.15	63	.01	.00	.01	5.	1.01	17.45	213	.02	.02	.00	557.
1.01	5.20	64	.01	.00	.01	6.	1.01	17.50	214	.02	.02	.00	557.
1.01	5.25	65	.01	.00	.01	6.	1.01	17.55	215	.02	.02	.00	557.
1.01	5.30	66	.01	.00	.01	6.	1.01	18.00	216	.02	.02	.00	557.
1.01	5.35	67	.01	.00	.01	6.	1.01	18.05	217	.02	.02	.00	439.
1.01	5.40	68	.01	.00	.01	7.	1.01	18.10	218	.02	.02	.00	231.
1.01	5.45	69	.01	.00	.01	7.	1.01	18.15	219	.02	.02	.00	124.
1.01	5.50	70	.01	.00	.01	7.	1.01	18.20	220	.02	.02	.00	88.
1.01	5.55	71	.01	.00	.01	7.	1.01	18.25	221	.02	.02	.00	62.
1.01	6.00	72	.01	.00	.01	7.	1.01	18.30	222	.02	.02	.00	55.
1.01	6.05	73	.07	.02	.05	16.	1.01	18.35	223	.02	.02	.00	52.
1.01	6.10	74	.07	.02	.05	31.	1.01	18.40	224	.02	.02	.00	51.
1.01	6.15	75	.07	.02	.05	41.	1.01	18.45	225	.02	.02	.00	51.
1.01	6.20	76	.07	.02	.04	49.	1.01	18.50	226	.02	.02	.00	51.
1.01	6.25	77	.07	.02	.04	54.	1.01	18.55	227	.02	.02	.00	51.
1.01	6.30	78	.07	.03	.04	59.	1.01	19.00	228	.02	.02	.00	51.
1.01	6.35	79	.07	.03	.04	63.	1.01	19.05	229	.02	.02	.00	51.
1.01	6.40	80	.07	.03	.04	67.	1.01	19.10	230	.02	.02	.00	51.
1.01	6.45	81	.07	.03	.04	71.	1.01	19.15	231	.02	.02	.00	51.
1.01	6.50	82	.07	.03	.04	74.	1.01	19.20	232	.02	.02	.00	51.
1.01	6.55	83	.07	.03	.03	78.	1.01	19.25	233	.02	.02	.00	51.
1.01	7.00	84	.07	.03	.03	81.	1.01	19.30	234	.02	.02	.00	51.
1.01	7.05	85	.07	.03	.03	84.	1.01	19.35	235	.02	.02	.00	51.
1.01	7.10	86	.07	.04	.03	87.	1.01	19.40	236	.02	.02	.00	51.
1.01	7.15	87	.07	.04	.03	89.	1.01	19.45	237	.02	.02	.00	51.
1.01	7.20	88	.07	.04	.03	92.	1.01	19.50	238	.02	.02	.00	51.
1.01	7.25	89	.07	.04	.03	94.	1.01	19.55	239	.02	.02	.00	51.
1.01	7.30	90	.07	.04	.03	97.	1.01	20.00	240	.02	.02	.00	51.
1.01	7.35	91	.07	.04	.03	99.	1.01	20.05	241	.02	.02	.00	51.
1.01	7.40	92	.07	.04	.03	101.	1.01	20.10	242	.02	.02	.00	51.
1.01	7.45	93	.07	.04	.03	103.	1.01	20.15	243	.02	.02	.00	51.
1.01	7.50	94	.07	.04	.02	105.	1.01	20.20	244	.02	.02	.00	51.
1.01	7.55	95	.07	.04	.02	107.	1.01	20.25	245	.02	.02	.00	51.
1.01	8.00	96	.07	.04	.02	109.	1.01	20.30	246	.02	.02	.00	51.
1.01	8.05	97	.07	.04	.02	110.	1.01	20.35	247	.02	.02	.00	51.
1.01	8.10	98	.07	.04	.02	112.	1.01	20.40	248	.02	.02	.00	51.
1.01	8.15	99	.07	.05	.02	114.	1.01	20.45	249	.02	.02	.00	51.
1.01	8.20	100	.07	.05	.02	115.	1.01	20.50	250	.02	.02	.00	51.
1.01	8.25	101	.07	.05	.02	117.	1.01	20.55	251	.02	.02	.00	51.
1.01	8.30	102	.07	.05	.02	118.	1.01	21.00	252	.02	.02	.00	51.
1.01	8.35	103	.07	.05	.02	119.	1.01	21.05	253	.02	.02	.00	51.
1.01	8.40	104	.07	.05	.02	121.	1.01	21.10	254	.02	.02	.00	51.
1.01	8.45	105	.07	.05	.02	122.	1.01	21.15	255	.02	.02	.00	51.
1.01	8.50	106	.07	.05	.02	123.	1.01	21.20	256	.02	.02	.00	51.
1.01	8.55	107	.07	.05	.02	124.	1.01	21.25	257	.02	.02	.00	51.
1.01	9.00	108	.07	.05	.02	125.	1.01	21.30	258	.02	.02	.00	51.
1.01	9.05	109	.07	.05	.02	126.	1.01	21.35	259	.02	.02	.00	51.
1.01	9.10	110	.07	.05	.02	127.	1.01	21.40	260	.02	.02	.00	51.
1.01	9.15	111	.07	.05	.02	128.	1.01	21.45	261	.02	.02	.00	51.
1.01	9.20	112	.07	.05	.02	129.	1.01	21.50	262	.02	.02	.00	51.
1.01	9.25	113	.07	.05	.02	130.	1.01	21.55	263	.02	.02	.00	51.
1.01	9.30	114	.07	.05	.01	131.	1.01	22.00	264	.02	.02	.00	51.
1.01	9.35	115	.07	.05	.01	132.	1.01	22.05	265	.02	.02	.00	51.

1.01	9.40	116	.07	.05	.01	133.	1.01	22.10	266	.02	.02	.00	51.
1.01	9.45	117	.07	.05	.01	134.	1.01	22.15	267	.02	.02	.00	51.
1.01	9.50	118	.07	.05	.01	135.	1.01	22.20	268	.02	.02	.00	51.
1.01	9.55	119	.07	.05	.01	136.	1.01	22.25	269	.02	.02	.00	51.
1.01	10.00	120	.07	.05	.01	136.	1.01	22.30	270	.02	.02	.00	51.
1.01	10.05	121	.07	.05	.01	137.	1.01	22.35	271	.02	.02	.00	51.
1.01	10.10	122	.07	.05	.01	137.	1.01	22.40	272	.02	.02	.00	51.
1.01	10.15	123	.07	.05	.01	138.	1.01	22.45	273	.02	.02	.00	51.
1.01	10.20	124	.07	.05	.01	139.	1.01	22.50	274	.02	.02	.00	51.
1.01	10.25	125	.07	.05	.01	139.	1.01	22.55	275	.02	.02	.00	51.
1.01	10.30	126	.07	.05	.01	140.	1.01	23.00	276	.02	.02	.00	51.
1.01	10.35	127	.07	.06	.01	141.	1.01	23.05	277	.02	.02	.00	51.
1.01	10.40	128	.07	.06	.01	141.	1.01	23.10	278	.02	.02	.00	51.
1.01	10.45	129	.07	.06	.01	142.	1.01	23.15	279	.02	.02	.00	51.
1.01	10.50	130	.07	.06	.01	142.	1.01	23.20	280	.02	.02	.00	51.
1.01	10.55	131	.07	.06	.01	143.	1.01	23.25	281	.02	.02	.00	51.
1.01	11.00	132	.07	.06	.01	143.	1.01	23.30	282	.02	.02	.00	51.
1.01	11.05	133	.07	.06	.01	144.	1.01	23.35	283	.02	.02	.00	51.
1.01	11.10	134	.07	.06	.01	144.	1.01	23.40	284	.02	.02	.00	51.
1.01	11.15	135	.07	.06	.01	145.	1.01	23.45	285	.02	.02	.00	51.
1.01	11.20	136	.07	.06	.01	145.	1.01	23.50	286	.02	.02	.00	51.
1.01	11.25	137	.07	.06	.01	146.	1.01	23.55	287	.02	.02	.00	51.
1.01	11.30	138	.07	.06	.01	146.	1.02	0.00	288	.02	.02	.00	51.
1.01	11.35	139	.07	.06	.01	147.	1.02	.05	289	0.00	0.00	0.00	19.
1.01	11.40	140	.07	.06	.01	147.	1.02	.10	290	0.00	0.00	0.00	18.
1.01	11.45	141	.07	.06	.01	147.	1.02	.15	291	0.00	0.00	0.00	7.
1.01	11.50	142	.07	.06	.01	148.	1.02	.20	292	0.00	0.00	0.00	3.
1.01	11.55	143	.07	.06	.01	148.	1.02	.25	293	0.00	0.00	0.00	1.
1.01	12.00	144	.07	.06	.01	149.	1.02	.30	294	0.00	0.00	0.00	0.
1.01	12.05	145	.20	.16	.02	219.	1.02	.35	295	0.00	0.00	0.00	0.
1.01	12.10	146	.20	.18	.02	383.	1.02	.40	296	0.00	0.00	0.00	0.
1.01	12.15	147	.20	.18	.02	408.	1.02	.45	297	0.00	0.00	0.00	0.
1.01	12.20	148	.20	.19	.02	437.	1.02	.50	298	0.00	0.00	0.00	0.
1.01	12.25	149	.20	.18	.02	450.	1.02	.55	299	0.00	0.00	0.00	0.
1.01	12.30	150	.20	.18	.02	456.	1.02	1.00	300	0.00	0.00	0.00	0.
									SUM	31.20	28.05	3.15	71668.
										(792.)	(713.)	(80.)	(2029.)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4247.	820.	249.	239.	71653.
CMS	120.	23.	7.	7.	2029.
INCHES		23.10	28.05	28.05	28.05
MM		586.81	712.55	712.55	712.55
AC-FT		408.	493.	493.	493.
THOUS CU M		501.	609.	609.	609.

HYDROGRAPH AT STA 11006 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	1.	1.	2.	2.	2.
2.	2.	3.	3.	3.	4.	4.	4.	4.	5.	5.
5.	5.	5.	6.	6.	6.	6.	7.	7.	7.	7.
9.	14.	18.	31.	41.	49.	54.	59.	63.	67.	71.
71.	74.	78.	81.	84.	87.	89.	92.	94.	97.	99.
99.	101.	103.	105.	107.	109.	110.	112.	114.	115.	

117.	118.	115.	141.	122.	124.	124.	125.	125.	187.
128.	129.	127.	151.	132.	135.	136.	138.	133.	136.
137.	137.	138.	139.	139.	140.	141.	141.	140.	142.
143.	144.	144.	144.	145.	145.	146.	146.	147.	147.
147.	144.	144.	149.	214.	345.	402.	437.	456.	456.
466.	463.	465.	467.	469.	470.	478.	535.	557.	567.
572.	575.	577.	578.	580.	581.	582.	583.	619.	688.
712.	725.	735.	736.	738.	740.	741.	742.	745.	745.
678.	663.	787.	968.	1235.	1972.	3598.	4247.	3188.	2234.
1534.	1232.	987.	837.	754.	724.	714.	709.	708.	708.
708.	705.	708.	706.	673.	611.	579.	566.	560.	558.
558.	557.	557.	557.	557.	557.	439.	231.	124.	80.
51.	55.	52.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	51.	51.
51.	51.	51.	51.	51.	51.	51.	51.	39.	18.
7.	3.	1.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4247.	809.	249.	239.	71655.
CMS	120.	23.	7.	7.	2029.
INCHES		23.10	28.05	28.05	28.05
MM		586.61	712.55	712.55	712.55
AC-FT		406.	493.	493.	493.
THOUS CU M		501.	609.	609.	609.

HYDROGRAPH AT STA 11006 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	1.	1.	1.
1.	1.	1.	1.	2.	2.	2.	2.	2.	2.
2.	3.	3.	3.	3.	3.	3.	3.	3.	4.
4.	4.	8.	15.	21.	24.	27.	29.	32.	34.
35.	37.	39.	40.	42.	43.	45.	46.	47.	48.
49.	51.	52.	53.	53.	54.	55.	56.	57.	58.
58.	59.	60.	60.	61.	62.	62.	63.	63.	64.
64.	65.	65.	66.	66.	66.	67.	67.	68.	68.
69.	69.	69.	69.	70.	70.	70.	71.	71.	71.
71.	72.	72.	72.	72.	73.	73.	73.	73.	73.
74.	74.	74.	74.	109.	171.	209.	218.	225.	226.
230.	232.	235.	234.	234.	235.	247.	267.	278.	283.
286.	287.	288.	289.	290.	291.	291.	292.	339.	340.
356.	363.	366.	368.	369.	378.	370.	371.	371.	372.
338.	331.	394.	483.	618.	986.	1797.	2124.	1594.	1120.
817.	616.	499.	417.	377.	362.	357.	355.	354.	354.
354.	354.	354.	354.	356.	305.	299.	293.	280.	279.
279.	279.	279.	279.	279.	279.	220.	116.	62.	40.
31.	28.	26.	25.	25.	25.	25.	25.	25.	25.
25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
25.	25.	25.	25.	25.	25.	25.	25.	25.	25.

25.	25.	25.	25.	25.	25.	25.	25.	19.	9.
4.	1.	1.	0.	0.	0.	0.	0.	0.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2124.	410.	124.	119.	35827.
CMS	60.	12.	4.	3.	1014.
INCHES		11.55	14.03	14.07	14.03
MM		293.41	356.28	356.29	356.28
AC-FT		203.	247.	247.	247.
THOUS CU M		251.	304.	304.	304.

....

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH ASPENHOFF LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
11006	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-617.	-1

STAGE	617.00	617.99	619.21	619.52	620.14	620.46	620.50	621.39	622.89
FLOW	0.00	19.00	117.00	160.00	273.00	344.00	350.00	1093.00	7233.00

CAPACITY=	0.	88.	127.	134.	559.
ELEVATION=	595.	617.	620.	621.	640.

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
617.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
620.5	0.0	0.0	0.

STATION 11006, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	2.	2.	3.	3.	4.	4.
[illegible]	6.	6.	7.	8.	9.	10.	10.	[illegible]	12.
13.	14.	15.	16.	16.	17.	18.	20.	24.	28.

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

MEAN FLOW AND STORAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 1.00	RATIO 2 .50
HYDROGRAPH AT	11006	.13	1	424.	212.
		(.85)		(12.02)	(6.00)
ROUTED TO	11006	.13	1	320.	160.
		(.85)		(9.06)	(4.53)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ***********

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	617.00	617.0	627.0
STORAGE	0.	0.	1350.
OUTFLOW	0.	0.	9999.

RATIO OF PMF	MAXIMUM RESERVOIR WS ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	621.7	1.55	1610.	3401.	5.00	17.75	0.00
.50	619.16	0.0	1490.	1609.	1.75	15.75	0.00

PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE= 79/09/07.
TIME= 0:15:41.

DAM SAFETY INSPECTION - MISSOURI
ASPENHOFF LAKE DAM (11006)
PERCENT OF PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

NQ	NRH	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	4	0

JOPER	NAT	IHPT	JTRACE
0	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS=	.21	.21	.22	.23	.24	.25	.26	.27	.29

SUB-AREA RUNOFF COMPUTATION

INPUT INDEX PRECIPITATION AND RATIOS, INPUT SCS UNIT HYDROGRAPH PARAMETERS

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	11006	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	.33	0.00	.33	1.00	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

STRKR	STRTL	CNSTL	ALSMX	RTIMP
0.00	0.00	1.00	0.00	0.00

STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-78.00	0.00	0.00

CURVE NO = -78.00 WETNESS = -1.00 EFFECT ON = 78.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .11

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

UM [illegible] 2a.00 3a1[illegible] 71568.
(732.31(715.81(30.31(2029.41)

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH ASPEN LAKE DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
11.00	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IPMP	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1			0.000	0.00	0.000	-617.	-1

STAGE	617.00	617.99	618.21	619.50	620.14	620.46	620.63	621.39	622.89
FLOW	0.00	13.00	117.00	150.00	278.00	344.00	556.00	1943.00	7233.00
CAPACITY=	0.	89.	127.	134.	150.				
ELEVATION=	595.	617.	620.	621.	640.				

	SPILL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
	617.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
620.5	0.0	0.0	0.

PEAK OUTFLOW IS 289. AT TIME 15.92 HOURS

PEAK OUTFLOW IS 312. AT TIME 15.92 HOURS

PEAK OUTFLOW IS 334. AT TIME 15.92 HOURS

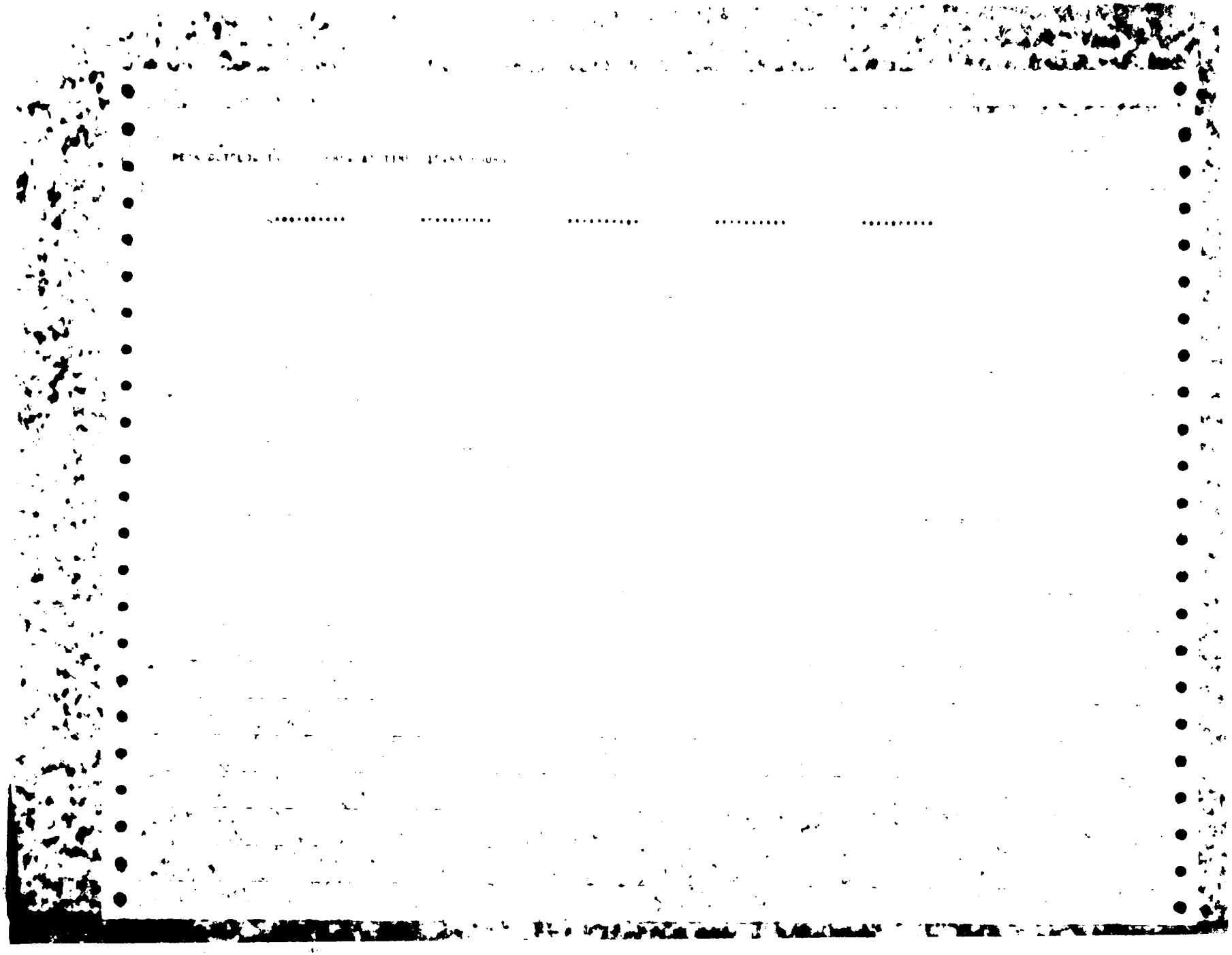
PEAK OUTFLOW IS 368. AT TIME 15.92 HOURS

PEAK OUTFLOW IS 434. AT TIME 15.92 HOURS

PEAK OUTFLOW IS 504. AT TIME 15.83 HOURS

PEAK OUTFLOW IS 564. AT TIME 15.83 HOURS

PEAK OUTFLOW IS 622. AT TIME 15.83 HOURS



PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				.0	.21	.22	.23	.24	.25	.26	.27	.28
HYDROGRAPH AT	1100	.73	1	849.	892.	934.	977.	1019.	1062.	1104.	1147.	1189.
		(1.89)		(24.05)	(25.26)	(26.45)	(27.66)	(28.87)	(30.07)	(31.27)	(32.47)	(33.68)
ROUTED TO	1100	.73	1	240.	312.	504.	504.	858.	564.	564.	602.	680.
		(1.89)		(6.80)	(8.83)	(9.63)	(10.03)	(12.40)	(14.28)	(15.97)	(17.62)	(19.26)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	617.00	617.00	620.50
STORAGE	64.	88.	154.
OUTFLOW	0.	0.	700.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	62[illegible].21	0.00	130.	283.	0.00	15.92	0.00
.21	620.31	0.00	131.	312.	0.00	15.92	0.00
.22	620.42	0.00	133.	334.	0.00	15.92	0.00
.23	620.51	.01	134.	368.	.17	15.92	0.00
.24	620.65	.05	135.	438.	.25	15.92	0.00
.25	620.78	.08	136.	508.	.42	15.83	0.00
.26	620.82	.12	137.	564.	.42	15.83	0.00
.27	620.86	.15	137.	622.	.42	15.83	0.00
.28	[illegible].88	.18	138.	680.	.42	15.83	0.00

END

DATE
FILMED
10-81

DTIC